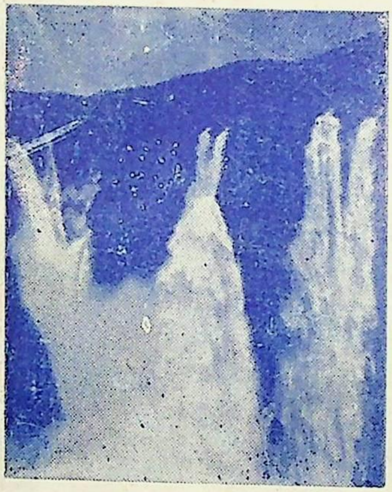
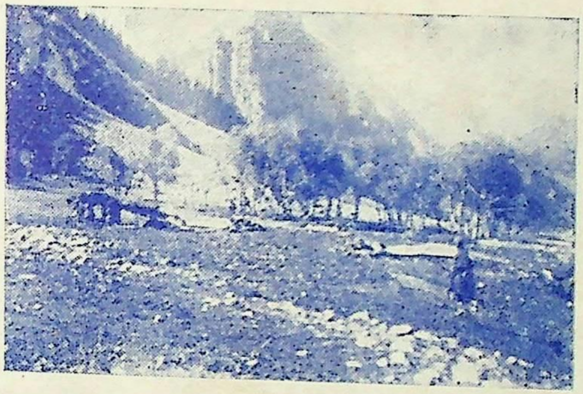
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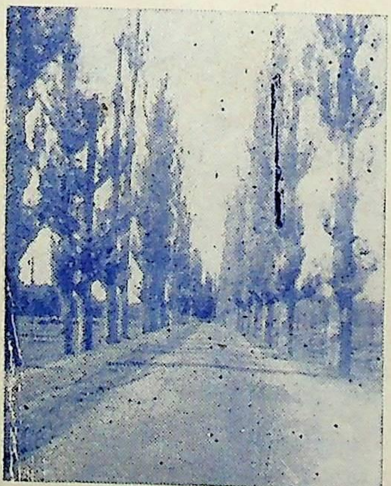
ARYA BHATT
VIJYAN PATRIKA

ENVIRONMENTAL CONSERVATION & ENRICHMENT











SEPTEMBER, 1983

**Gurukula Kangri Vishwavidyalaya
Hardwar**

EDITOR :
Dr. V. SHANKER

AGAR CHAHTE SUKH SE JEENA
NAHIN BHULNA VRIKSHA SEECHNA



Dy. Minister Environment, Govt. of India, Mr. Y. Digvijai Singh watering the Banyan rapling planted by him in the University on 'World Environment Day' 1983. On his left are Dr. V. Shanker Organising Secretary and Dr. B. D. Joshi. Sitting : Mr. Suraj Din, Dr. J. D. Vedalankar & Mr. Kart[illegible]ngh are standing on the right of Hon'[illegible] Dy. Minister.

World Environment Day 1983

Environmental Conservation and Enrichment

(Proceedings of the conference held at Gurukula Kangri Vishwavidyalaya, Hardwar, June 5-6, 1983)

Financed by

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Dr. V. SHANKER
Asst. Editor
P. KAUSHIK

'Aryabhatt Vijyan Patrika' special issue
September, 1983

Contents

World Environment Day Celebrations

Gurukul Kangri Vishwavidyalaya celebrated the 'World Environment Day' this year on June 5 and 6 on the campus and in Kangri village.

The various programmes organised on this occasion were :

I Conference on 'Environmental Conservation and Enrichment'.

II Exhibition on "Environment".

III Environmental Education Extension.

The above programmes covered a wide spectrum of environmental topics such as Tree plantation, Energy, Salinity, Siltation, Erosion, Floods, Endangered species, Environmental planning extension, Environment in Vedas and in ancient literature etc.

On behalf of the Vishwavidyalaya I wish to record our sincere thanks to Shri Digvijai Singh Dy. Minister Environment Govt. of India who was kind enough to spare valuable time from his busy scheduled and addressed the conference on June 6, 1983 Grateful thanks are also due to the various scientists who participated in the conference and other programmes and contributed their learned articles.

I am glad that these articles and other material (poems etc.) prepared for the occasion are being published. I am sure these will greatly benefit in creating environmental awareness and in moulding our basic attitude towards environment leading to its conservation and enrichment so necessary for the very survival of human race.

I congratulate the members of the organising committee, World Environment Day 1983 especially its Secretary Dr. V. Shanker, Head, Botany deptt. for successfully organising the programme.

G. B. K. HOOJA, I. A. S. (Retd.)
Vice-Chancellor
Gurukul Kangri University
Hardwar

Dr. T.N. KHOSHOO
Secretary

DEPARTMENT OF ENVIRONMENT
Bikaner House, Shahjahan
New Delhi-110011

August 1, 1983.

Dear Dr. Shanker,

Thank you for your letter of July 29. I am happy that you are bringing out a special issue of Aryabhatt on World Environment Day. I wish you all success.

With kind regards,

Sincerely yours,

Sd/

(T. N. Khoshoo)

Dr. V. Shanker,
Reader & Head,
Department of Botany,
Gurukul Kangri University,
Gurukul Kangri 249404,
Hardwar.

Editorial

The earth's capacity to support people is being irreversibly reduced in both developing and developed countries. As a result of deforestation and poor land management thousands of millions of tonnes of soil are lost every year. In developing countries alone, every year about 3000 km^2 of prime farmland disappear under buildings and roads. The rural poor in the developing countries, including 500 million malnourished and 800 million destitute, continuously strip the land of trees and shrubs for fuel. They are also obliged to burn every year 400 million tonnes of dung and crop residues which are badly needed to regenerate soils. Siltation is cutting the lifetimes of reservoirs supplying water and hydroectricity. Floods devastate crops and settlements. In india alone the annual cost of floods ranges from 140 million dollars to 750 million dollars. The tropical forests are shrinking so fast that by the year 2000 the remaining area of unlogged productive forest will have been halved. The coastal support system of many fisheries are being polluted.

Today, one-third of the world has no access to potable water, no shelter worth the name, no purchasing power to buy sufficient food even though it may be available, and no defence against erosion and plunder of community resources in the form of rivers, land and forests. Natural calamities are on the increase, each subsequent famine or flood being more disastrous than the preceding one. Primary life support systems are collapsing against the onslaught of a mindless technology.

Analysing the Indian situation we find that we are losing 5 to 6 thousand million tons of top soil every year. India has a total land area of 328 million ha. About one-half of this land is in various stages of degradation due to water and wind erosion, salination, alkalisation, water logging, ravines, & shifting cultivation. It should, therefore, not surprise us that more than half of our population is under poverty line. We in India call our land the mother earth. But have we cared for this mother who has been made sick and impoverished. The result of our negligence is before us. A sick mother cannot bear healthy children.

In our country about 40 million ha. are subject to floods. The core of the problem lies in the Indo-gangetic basin.

Annually crores of rupees are spent in meeting the disaster. The intensity and extent of these floods could be much less but for man's thoughtless action, over-exploitation of vegetation and forests, mismanagement of soils in critical areas of watersheds and reduction in the capacity of agricultural lands to retain water. As a result of this thoughtless action the flood affected area which was 25 million ha. in 1950 has now grown to 40 million ha. The construction of dams from 1952 onwards for which 400,000 ha. of land had to be deforested coincides with the period of increase in flood-affected area. This makes the connection obvious.

Most of the area in our country is semi-arid and arid so that the problem of salinity and alkali is a natural phenomenon. About 7 million ha. are affected by salinity and 6 million ha. wlth water-logging. The problem is increasing in the newly irrigated areas.

The Stockholm Conference (1972) proclaimed that "the protecion and improvement of the .. environment is a major issue which affects the well-being of peoples and economic development throughout the world; it is the urgent desire of the peoples of the whole world and the duty of all Governments." Although environmental consciousness has expanded greatly since 1972, real actions to fulfil the pledge have been inadequate. Thus the post-Stockholm era has witnessed dramatic rise in transport system, soil degradation, militarization and in destruction of tropical forests all of which have an extensive environmental impact. The protection of man and his environment from these and other hazards is necessary.

The environmental degradation is the outcome of indiscriminate exploitation of natural resources without taking into account basic ecological and environmental principles. We have to agree that as long as these ecological principles are ignored environmental problems will persist and survival itself will be in jeopardy.

The pages that follow, cover a wide spectrum of environmental topics, that made a part of the articles contributed to the conference on 'Environmental Conser–vation and Enrichment', organised on 'World Environment Day 1983', at Gurukula Kangri University, Hardwar and at Kangri village. It is hoped they shall rekindle our interest in environment conservation and enrichment and equip us with a better understanding of the basic principles that must be followed in building an enduring and prospering eco- system. *The future will be what we make it.*

V. Shanker

Gurukul Kangri Vishwavidyalaya, Hardwar
Conference on 'Environmental Conservation and Enrichment'

Address by
SHRI DIGVIJAY SINGH
Hon'ble Dy. Minister of Environment
Govt. of India

Mr. Vice-Chancellor, Academics of the Vishwavidyalaya, distinguished delegates and friends.

It is my undiluted pleasure to speak to you today on a topic of great significance that is 'Environment'. I am really grateful to your institution to the Vice-Chancellor, Registrar and Dr. V. Shanker, the Organising Secretary of this conference for the kind invitation extended to me to address the conference. Your great institution has a deep interest in 'environment' and is today celebrating 'World Enviroment' and is today celebrating 'World Environment day' is a matter of great pleasure. Hardwar is very rich in vegetation. The river Ganga flows here. It is an area endowed with great natural beauty. Nature has been very kind here. In many parts of the country forests have been cleared from large areas resulting in the destruction of natural vegetation and beauty. This has lead to soil erosion, disturbance of water cycle, increased incidence of floods and landslides. Mining activity in Doon valley has resulted in removal of the surface soil, increased incidence of landslides and other ecological problems. We must realise that natural resources are not unlimited. Today's problems have taken centuries to grow into their present threatening proportions. Man in his greed has ignored natural laws. He has disturbed the equilibrium of nature. The need of the hour is to arouse awareness of our environmental problems so that people would themselves act instead of looking to the Government for everything. I am glad that Gurukul Kangri Vishwavidyalaya has been working in this direction. Through its publications Arya Bhatt etc. and by organising exhibitions, tree-plantation programmes, conferences etc. the Vishwavidyalaya has made significant contribution in consciousness-raising and environment-improvement. The department of Environment Govt. of India and of

Uttar Pradesh shall be happy to render whatever assistance is needed by your great institution for any work on 'environment' you purpose to take up.

Air, water and Soil constitute our environment. The air we breathe, the water we drink and the earth on which we tread are such taken forgranted that ordinarily we bestow hardly any attention on them. As many of you would be knowing the United Nations Conference on Human Environment, held in June 1972 at Stockholm and which I had the privilege of attending. was the first in a series of international efforts at focusing attention on the environment.

While the early definition of environment was essentially concerned with problems of pollution and depletion of resources, the definition has, over the years been broadened to include all aspects of environmental problems. Environmental pollution is the price we have to pay for industrialisation. However, as there is no going back on industrialisation, our efforts, should be directed to reaping the benefits of industrial progress through scientific innovations and also eliminating the hazards of environmental pollution as far as possible. The very purpose of economic progress is to improve the quality of our lives and this purpose gets defeated if we do not take care of our environment.

With industrialisation the wastes have become both large and varied, exuding air water and solid effluents and these are increasing with the growth of urbanisation. It is estimated that industry leaves wastes exceeding 50% of the raw materials used.

Consciousness has not yet truly arisen whereby a concern would develop in the society at large, for cleanliness outside one's own house. If such a civic sense has not arisen individually, how can one expect it collectively ? This is the very fundamental reason why industries are dragging the feet in installing pollution abatement equipment.

Water and Air pollution abatement have been issues that have been recognised by society at least for the last few years. Legislation has been introduced in both these areas re-inforced by Rules and even Cess Act for water pollution. But for solid wastes there is no comprehensive legislation and its public acceptance is dependent only on civic sense as well as on the feasibility of re-cycling.

Solid wastes are the larger polluters of the land and in advanced countries, vast sums are spent for their disposal and re-use. In the U.S.A. one decade ago, 365 million

tonnes of wastes were generated annually and the cost of their disposal without recovery was 5½ billion dollars. This is repeated in every developed country.

Dumping of solid wastes create danger of ground water and air pollution, spreading disease through contaminated water, stink, mosquito, flies, rodents and other pests. Moreover, release of gases in the atmosphere are severe health hazards.

Some industrial wastes present fire risk and some other may present the risk of explosions. They are dangerous to handle because of their effect on the skin, particularly to children.

A question now is not of merely putting the wastes "out of sight and out of mind" but of getting the best by re-cycling them, keeping in view the age-old saying that "dirt is the richest in the wrong places."

According to some reports about 200 million tons of solid wastes are generated annually in our country and the cost of disposal runs into several crores of rupees. Solid waste abatement has received vary little attention of date. At present there are no national standards and regulations dealing with solid waste collection, transportation, processing and disposal. These wastes can be converted into useful products to conserve energy, avoid environmental pollution and economise by adopting new techniques.

In big cities like Bombay, Calcutta and Madras, the disposal of human waste is posing a very serious problem. In Bombay, we periodically hear of the outbreak of jaundice which is often attributed to water pollution. It is well known that beaches of Bombay as well as Madras are heavily contaminated.

China it is said, has successfuly tackled the problem of disposal of human wastes by producing biogas. But in our country the idea of extracting biogas from human wastes is frowned upon. However, it is becoming incre singly clear that unless the nightsoil is used for biogas, environmental pollution will continue in major cities. Ministry of Railways have made an indepth study of the application of biogas technology for recycling of organic wastes and sanitation, according to which biogas technology may provide the only viable sanitation alternative, which India can afford.

When the organic wastes are processed, we get what is popularly known as Compost Manure. As many as 4000 years ago, the chinese are credited with the making of compost for agricultural purposes. Though the importance of

compost for agriculture in our country has slightly slackened with theadvent of chemical fertilisers, internationally compost is regaining its popularity, particularly because of its role as a pollution control measure.

In all the new suburban developments around growing towns, there is a need for an integrated system for waste recycling and energy and fertiliser supply, on a single house basis. This is because, even though toilet waste is handled by a septic tank soak-pit arrangement, kitchen and bathroom water and solid organic wastes have to be discharged outside the house. I am glad to know that a biogas based domestic waste recycling system has been designed and constructed by TERI Field Research Unit, in a residence in Pondichery which has been successfully working for over a year now

Concern for controlling pollution which is growing among the people at large, is also being counter balanced by the Government giving further support to industry to meet with the costs of pollution control.

In the current Budget, the Finance Ministry accepted the suggestions proposed by my deparment, to give up to 75% tax relief on depreciation on the amount spent for installing equipment to prevent water and air pollution. Moreover, to avoid congestion in over-crowded metropolitan cities, capital gains tax has been waived on the sale of land, plant & machinery and buildings of any industry that wishes to shift out of such a city and sell its assets.

The Department of Enviroment is also actively pursuing with every State Government, to see that collective water treatment systems are established for treating effluents from industries that are located in the proximity. This is best done through Industrial Development Corporations of State Governments that are setting up such industrial estates. The glaring example is in Gujarat where a Rs. 12 crore project or collective treatment from 10 large industries has been completed in Baroda. Collective treatment from 1300 small scale units at Jetpur in Gujarat will be treated under a project which is being constructed and it is proposed to put up a Rs. 14 crore project for the collective treatment of the chemical industries at Vapi in South Gujarat. Similar systems have been established at Pali in Rajasthan and in several other parts of India.

Pollution problems have grown and assume such proportions that at a recent

meeting of all the Pollution Control Boards of India it was unanimously decided that measures should be found by amending laws wherby special courts should be set-up for speedy dispensation of the law and that industrial licences should be suspended if an industrial unit persists in continuing to pollute by procuring stay orders after prosecution. Ariticle 226 of the Constitution enables any individual to vacate such a stay order in two weeks and I am certain that concerned persons throughout the country will start doing so, to to counter act the delaying tactics of polluting industries.

The holy rivers Ganga and Yamuna have now ended up being one of the most polluted in the world, although this is not resulting from industrial pollution so much as it is from domestic sewerage. Kanpur is perhaps the most critical in its problem of water pollution from both urban as well as industrial sources. It is proposed now to set-up a Ganga Valley Authority to control and monitor the levels of pollution in the Ganga and the Yamuna rivers in the States of U. P., Bihar, and West Bengal.

In Bombay, I understand that every day nearly 330 million litres of untreated domestic sewage and some 21 million litres of industrial effluents are being released into the Mahim Creek. An estimated 1500 tonnes of pollutants are released into Bombay's atmosphere everyday from various sources. I understand that the Bombay Municipal Corporation proposes to completely halt the discharge of raw sewage into the Mahim Creek by 1986. The problem in Madras is also very similar requiring urgent attention.

India is making steady progress in respect of biogas production from animal and human wastes. In densely populated cities like Bombay, human waste pose a very serious problem. The Commission for Additional Sources of Energy has initiated a programme of setting up experimental community biogas plants under the All India Co-ordinated Biogas Project. The Khadi and Village Industries Commission has been entrusted with the task of designing and executing community biogas plants. The Khadi Commission announced that the Commission is confident of setting up 25,000 biogas plants in the current financial year, more than double the number of plants set in the previous year.

In the field of technology also, much progress is being made, For example scientists of IIT in New Delhi claim to have

developed a novel technology of biogas concersion into portable energy. According to the IIT's Biochemical Research Centre, biotechnology process can yield energy equivalent of 285 million tonnes of coal by conversion of an estimated 1555 million tonnes of biomass available in the country.

Another interesting news that hit the headlines recently is that rice husk, a renewable source of energy is available to the tune of 18 million tonnes, in the country, and that properly exploited, it can help run a vast number of rural industries. This is again a case of discovering 'riches' in what is normally considered as waste product.

Problem created by technology can also be solved by technology. This is indeed a comforting thought. I understand that nuclear energy can be used for treating wastes. Sometime ago bulletins were published by BARC saying that West Germany had successfully tried treating wastes like garbage and rubbish with cobalt rays, which not only kill bacteria but also remove the foul smell from wastes.

Today environmental engineering is being recognised as an important branch of learning and premier educational institutions like the IITs are having separate departments for Research, Development, Consultancy and Information dissemination in the field of the environment. At the national level these are being carried out by the National Environmental Engineering Research Institute, at Nagpur. I would urge that at all levels in our educational curricula there should be provision for the teaching of environmental health. The need of the hour is to arouse public consciousness about our pollution problems so that people would themselves act instead of looking to the Government and Corporations for everything. The environmental pollution in major cities like Bombay, Madras and Calcutta is collasal. Unless this awareness percolates to every segment of the population, the lives of those who live in the cities will be imperilled. A great responsibility is cast on the industrialists and factory owners, and private and public sector undertakings, to act with the conviction that a clean environment and development are two sides of the same coin.

It is heartening to note that much awareness has developed in the recent past. The universities, public at large and the voluntary agencies have to play a major role in the efforts to safeguard the environment. Our scientists, the professionals and the Managers have to obviously take the leading part in this connection.

Thank you

"Environment and Developmental Planning"

K. K. Jain and N. L. Ramanathan
Department of Environment, New Delhi.

1. Introduction

1.1 Spread of Environmental disruption

From the Arctic to Antarctic. from the islands of the pacific to the heart land of the rainforests, environmental deterioration appears to be accelerating. Irreplaceable natural communities that have sustained life on earth for millions of years, wild species that have been the associates of man since he first appeared on the planet, and all the vast, wild landscapes that have enriched the human soul now stand threa ened. Most insidious have been the spread of those hidden destroyers of life, the chemical poisons released by man, that now work through plant and animal communities and endanger all life.

1.2 Payment for Past errors.

During the history of humanity, people have made mistakes in their relationship to the world they lived in and to one another. Our ancestors however, were able to postpone the day of reeknoking. They were able to seek present profit without too much concern for the future impacts of their actions. There were many who said, "Let posterity worry". We are the posterity they were reffering to. During our life-time, we must find solutions to this problem of environmental crisis. How can human beings continue to live on the earth without destroying the environment on which their very lives depend? Sustainable ways of lifestyles must be designed and the destructive ways of life must be abandoned. Without doing so there may be no posterity.

2. Environment-Development

2.1 Factors deciding Human Environment.

The problem of the human environment derive essentially from three factors. The first is the phenomenal increase in human and cattle populations on earth, the second is the one-sided or at best narrow, application of technology without due regard to its effects on the environment and on man himself; the third, is the lack of control over land use for the benefit of the total society.

2 2 The Six R's Remedy.

The problem is widespread, diverse complex and pressing today, both in developed and developing societies. An equilibrium between population, resources and environment and development must be sought, established and maintained. This is what environmental protection, conservations, pollution abatement or call it by any other name, is about. The answers lie in the simple "Six R's" strategy namely :

(1) Restrict and regulate the use of natural resources, especially non-renewal ones;

(2) Regenerate degraded environments, especially renewable resources;

(3) Reduce pollution generation and discharge;

(4) Recycle and reuse wastes produced by one activity for another economically viable activity;

(5) Revise and review technology of production for avoiding wastes and increasing productivity;

(6) Respond imaginatively and innovatively to management concepts for environmental protection and conservation.

2. 3 Public awareness and action.

If public awareness can be translated into effective action, the deterioration of the environment can be halted. Environmental conservation is one approach towards achieving a better ecological balance. There is much debate at present on public involvement and participation in environmental conservation programmes. The environment and its state is no doubt of great public concern.

All our planning efforts are directed at the satisfaction of the needs and aspirations of the public at large. Nevertheless, it is a common experience that the community can make or mar programmes for environmental improvement. So much so, the co-determination of the public in envirornmental planning is a vital element for its success. It is, therefore, necessary that an adequate public information system is developed to keep the community well informed about environmental problems and the ways in which it is proposed to reduce them. A well informed public would readily respond to the call for co-operation with agencies responsible for implementing environmental protection and conservation programmes.

2.4 The environmental Web.

When we talk of the environment we include the plants, the animals, the micro-flora, microfauna, the soil, the air, the water, minerals, metals, and, last but not least, man himself. All these components of the environment are part of a complex, interlinked web of life. Destruction of any part of this web means damage to or even destruction of life itself.

2.5 Quality of Human Environment.

The global anxiety about the quality of the human environment is concerned with two issues. These are :-

(a) The management of resources in the environment for developmental use in a sustainable manner; and

(b) The conservation and protection of what is rare and precious in nature.

There is no conflict between developmental and environmental goals, and development is possible without destruction of the environment Taking a long view, conservation incorporates developmental use of resources and development strategies should respect and include conservation needs.

3. Development

3.1 Meaning of Development.

Development is an all embracing term, which has several connotations depending on the context in which it is used. Most often it is used to signify the type of development, such as industrial or technological progress, economic or social advancement or agricultural or rural growth In sum, the end objective of developm nt, irrespective of the sector involved is the betterment of the "quality of life". Every nation and every community is relantlessly persuing this goal, which itself is ill defined. However, development depends more than anything, on the availability of resources, both natural and human. Shrimati Gandhi has aptly stated "Conservation cannot be at the cost of development of our people".

3.2 Resources for Development.

Development implies the adding of value to the resources available through appropriate technology. Development is also equally concerned with augmenting available resources, and often with creation of additional resources. It is readily apparent, therefore, development is nothing but 'resources management' for optium benefit. It must necessarily incorporate exploration for resources, creating and husbanding resources, controlled or optimal exploitation, recycling and reuse of resources and the avoidance of waste.

4. Environmental Management.

4.1 Environmental Management as Development Objective.

Environmental management is aimed at optimal use of natural and man-made resources in a sustainable manner, without depleting, degrading or destroying the environment. In other words, environmental management counsels that it is essential to protect what is to be protected and conserve what is to be conserved in the environment and optimize the use of the rest, so that the present needs of people are met without disregard for the development options of the future. Environmental Management, therefore, is, in itself, a development objective and is an approach for attaining continuing development.

4.2 Strategies for development Planning.

What does planning a development scheme involve ? It provides an opportunity to consider alternative strategies for development, such as whether the technology adopted is labour intensive or mechanized, what the product mix should be and so on, and justify the rationale for the chosen development path Perhaps, the proposed development might conflict wlth a laid down policy, for example release of forest land for non-forest purposes, manufacture of banned items, rendering many unskilled people unemployed or result is in-migration of population into a tribal area. Such conflicts have to be resolved before more detailed planning can proceed. In many cases simultaneous or sequential use of resources may be possible and should be given due weight in planning.

4.3 Project Appraisal.

The assessment of the development proposal for economic viability, technical feasibility and environmental compatibility is the next crucial step. Several techniques for environmental assessment of development projects have been developed. Environmental Impact Analysis makes it possible to examine proposed development schemes, identify the type and extent of beneficial and adverse influences on the environmental elements and society. design anticipatory measures to reduce undesireable effects and to optimize benefits and help to choose among alternative sites, technology or application.

4.4 Environmental Assessment.

Environmental assessment can be constructively related to development. The procedure begins by listing resources

used or affected directly or indirectly, the residues created and, then quantifying both positive and negative effects, in terms of resource enhancement and creation and resource depletion and degradation. The procedure also helps to highlight additional inputs necessary to (a) restore, maintain and improve the environment, such as pollution abatement, afforestation, soil treatment etc., and (b) sustain production, conservation of natura' and cultural resources, manpower training, acquisition of skills etc. This technique has been tested in only a few cases, but deserves to be tested more thoroughly in various kinds of development projects, both for ascertaining its validity and relevance and for refining the technique for precision and predictability.

4 5 Monitoring and evaluation of environmental measures.

Further, it is important to monitor and evaluate the development project after its implementation for several reasons other than checking comliance of implementation and operation of environmental safegaurds. For example, a subsequent change in process technology, major augmentation of capacity, or change in final siting of the project may necessitate a reassessment from the environmental angle.

5. CONCLUSION

5.1 Stress on Environmental Education.

Ultimately, success can be ensured only as a result of creating public awareness of the environmental issues of the grave dangers confronting the human race if it do not proceed with ecological wisdom. To create such awareness throughout the country will involve a gignatic effort beginning with school education and ultimately convering all men, women and children on this land. This will take time but we would have taken an important step forward if we can make the group of these who take important decisions that affect the environment such as major hydel stations, petrochemical complexes, nuclear and thermal power stations, mining projects, etc., aware of ecological considerations that should be borne in mind even in the initial stages of planning development.

In this, intellectuals like the members of our scientific acadmics and other learned bodies could play a catalytic role. No need to say that there must be no development and that the environment must remain pristine. In planning development we have to ensure that the objectives of development very clearly define environmental safegaurds and in implementation we must

take all possible steps to ensure that resources, are not damaged or if unavoidable only as little as possible, that the ecosystem is not disrupted and that non-renewable resources, are conserved and renewable ones protected from over-exploitation. In other words, development action and environmental conservation are blended into a single, strong strand.

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The Role of Agnihotra to combat the menace of enviromental pollution

G. B. K. Hooja, I. A. S. (Retd.)
Vice-Chancellor, Gurukul Kangri University, Hardwar

Rishi Dayananda had foreseen a hundred years ago the problem of environmental pollution which has come under the focus of the world scientists and Governments now, only in the last decade or so. As an ameliorative measure he advocated an extraordinary device which deserves serious scrutiny at the hands of the scientists, and may possible offer an effective solution to combat this growing mence. The solution is the daily *Agnihotra* (fire ceremony) to be performed by all house-holders individually or collectively.

In the preface to his work, *Rigvedadi Bhasya*, Swami Dayananda writes. "In the entire gamut of *Yajnas* (fire ceremonies) fro mthe *Agnihotra* to the *Ashwamedha* four kinds of materials are burnt. Firstly, there are the aromatic substances, eg., *Kasturi Kesar*, etc. Secondly, there are sweet substances, eg. Gur, honey, etc. Thirdly, there are materials capable of aiding development and growth, eg., *ghee*, milk, grains, etc. Lastly, there are the *Soma* (juices), medicines, etc All these four substances when mixed and burnt properly in the fire under certain conditions purify air, water and the earth. The whole world is thus benefitted by the *yajna*."

Rishi Dayananda, following the injunctions of the Vedas, preached to mankind, "O man, you for the sake of the purity of air, herbs and the rain-water and for the welfare of all, burn in the fire, pure things like *ghee* and wood such as that of mango and *dhak*." He said that man was responsible for spreading environmental pollution by discharging faecal matter and during the course of respiration. It was, therefore, his social duty to take concrete measures to eliminate pollution. This could be discharged by performing the daily *Agnihotra*.

The Yajurveda says, "अद्रि रसि वनस्पतयः", which means, the clouds are formed by the vegetation. When vegetation and *ghee*, etc., are usad as offerings in the *yajna* (ceremony) they get converted into

small but powerful molecules and generate winds. While explaining the value of the *Ahutis* (offerings) of the evening *yajna* Swami Dayananda said, "Fire is the flame-shaped God. With His blessings, we perform *Havan* (fire ceremony) for the welfare of mankind. He has created the fire so that fire by splitting the materials into molecules and atoms may mix them with air and rain-water to purify the atmos-phere. Thus there shall be accretion to the hygienic conditions of the world." It stands to reason that the purification of water and air is possible through the performance of the *Agnihotra* It has been mentioned in the Yajurveda, "The fire of the planets like the god Sun along with air and light are extremely useful for the world and rectify the disequilibrium of our environment."

Natural balance—Similarly, it has been mentioned in the Atharvaveda, "The crea-tor of the universe balanced nature by the *yajna*" Fire possesses the power to destroy various types of poisonous elements. Thus, various bodily ailments could be cured and pollution could also be controlled by the use of fire. Again, the Atharvaveda says, "The known and the unknown diseases, such as *Rajayakshma* environmental pollution, etc., can be treated with *Ahutis* of *Indra* (water) and *Agni* (fire)."

There are several *Mantras* (hymns) which describe the role of *Agnihotra* in maintaining natural balance and coordi-nation of natural forces. "There are thousands of forces in the *Havan* to control pollution."

The minute particles of *ghee*, milk, grams, etc., used in the *Havan* get mixed up with the waters of the sky and are recovered on the earth through air, water and grains and hence function as carriers of *parakrama* (high endeavour).

The Science of Meteorelogy—It is self-evident that the primary effect of *yajna* is to hot up the temperature of the surrounding air. On becoming hot the air ascends upwards and a vacuum is thus phenomenon. The rise in temperature depends on the *ahutis* also. The smoke of the *yajna* that arises from the burning of various materials throws up small particles upwards. These gaseous particles are attracted by the clouds and eventually descend on earth in the form of rain.

On the basis of the Shatpath Brahman Swami Dayananda stated in the preface of the Rigvedadi Bhasya, "The materials of the *yajna* are burnt in the fire which give rise to smoke and steam because it is in the nature of fire to consume materials like

trees, herbs and water and split them into atmos, i.e., to cause decomposition. These, being light, go upwards in the sky. The liquid in these particles is called steam and the dry ones partake of the earth. These atoms and molecules in the clouds are lifted and supported by the air; then they intermix with each other and form *Vristi* (rain) which produces herbs (which in turn produce medicines) and grains, and the grains form the basis of *Virya* (vitality), the *Viiya* forms the body and the body pulsates into activity."

Rishi Dayananda quoted the Purvamimansa Dharma Shastra to say that the consumption of four types of aromatic materials (after having mixed them well) in the fire proves extremely beneficial for the world at large. The aroma of herbs (being used as condiments) mixed with pulse which is generated in the process of frying the two in *ghee,* and the vapours which are produced from the *yajna* make air, rain and water free from defects, disseminate fragrance and make the world happy and, therefore, the *yajna* leads to the welfare of mankind."

Similarly, quoting the authority of the Aitareya Brahmana, Swamiji writes, "There is a vast gr·up of humanity which benefits from the *yajna* and the scholar who thus ignites the materials is also the recipient of pleasure because a man who does good to the world is equally rewarded by the gods. Therefore, the net effect of the *yajna* is to remove the impurities of the world and to increase happiness But the person who performs the *yajna* should be conversant with the prescribed ritual and be possessive of high education and technical skill. A *yajna* performed thus yields good results and benefits the performer."

The value of *Agnihotra* to combat the menace of pollution has also been described in the Taittiriya Upanishad. To quote the words Swami Dayananda : "The infinite power of God produced the sky, air, fire, water and the earth and as a consequence of their *karmas* (actions) of the previous births creatures are born and destroyed. Here Brahma is synonym for grain; and all exist according to their *karmas.* Because of the power of God, the universe is sub–divided into three categories, and the grain is called Brahma as it is the basis of existense of all organisms. When air, water and medicines are purified by *yajna* the world becomes habitable and comfortable, otherwise it becomes polluted and uncomfertable. Therefore, the purification of these elements is the primary social necessity."

A hundred years ago, Swami Dayananda put forth his views on environmental pollution in the most scientific and forceful manner. Addressing the common folk and illiterate masses he said, "There are two agencies which work for the generation of atmosphere. Firstly, there is God. He has created powerful sources in the form of fire, (sun) and the fragrant flowers. As stated earlier, the sum absorbs all kinds of *Rasas* (juices) of the world and the fragrance of the flowers helps to moderate foul odour. Thus the compound as a result of the interaction of fragrance and foul odour (being emitted by living creatures) is subjected to a moderating effect and air and water acquire a medium quality. The fall of such water produces grains, vital force and bodies of a medium quality and as the sum result of these quality of intelligence, strength, industry, patience and courage also becomes of medium type, for as you sow, so shall you reap. The phenomenon of air, rain and water, becoming defective is noticeable everywhere. This deficiency is caused not by God but by man. Therefore, it is appropriate for man to combat pollution.

The *yajna* is the sky to the welfare of mankind and nonperformance of *yajna* makes man then defaulter. It is seif-evident that where there are large groups of men, bad odour is also generated proportionately. As stated above, this bad odour is not produced by God but be man and his pet animals. Man maintains the elephants, horses and herds of cows for his own comfort and the bad obour caused by these animals is due to his desire for comforts. Thus, it may be concluded that the bad odour which despoils air and water is caused by man and it is his primary duty to get rid of it."

Swami Dayananda said," Man is the best of all the creation. Only he is capable of discriminating between good or evil. *Manan* means to think; hence has originated the word *Manusya* (man). God has created man's body with a special combination of such faculties that he may acquire knowledge. Therefore, man alone is capable of following *Dharma* (social duty) and reject *Adharma* (social evil) and none else. So it is incumbent upon man to perform the *yajna*."

Following these injunctions of Swami Dayananda and having appreciated the social significance of the *yajna*, the Arya Samaj and the Aryas have developed over the years a tradition of performing *yajnas* on festival occasions, in general assemblies and in their homes according to prescribed

rules and regulations. But apparently the *yajnas* have so far been deemed to be a sort of ritualistic mumbo jumbo by the scientific community and no analytic research has been carried out by the scientists to verify the assertions of Rishi Dayananda made over a 100 years ago. Possibly, it was due to the fact that so far the scientist had remained blissfully unaware of the seriousness of the menace of environmental pollution.

Not yet too late, this problem has now caught the awareness of the scientific community, and the environmentalists all over the world have become panicky and are frantically investigating appropriate measures how to combat this serious problem which threatens to engulf mankind. Here is Dayananda's formula for them to examine and to verify by further researches.

Reclamation of Salt Affected Soils Protects the Environment

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HISTORICAL BACKGROUND

During the Vedic period (C 2000-600 B.C), the peasants dug wells and construted canals to supply water to the crops. Till this period, there was no record of the rise of salinity in these irrigated tracts. The development of canal irrigation began in the second half of the 14th century at the initiative of Sultan Feroz Shah Tughlak (1351-88) for the development of agriculture. During his reign, extensive irrigation works were planned and executed to stabilise the agricultural economy. Five big canals were dug to distribute the water of Jhelum, Yamuna and Sutlej for irrigation, of which the most important was the western Yamuna canal, the oldest canal of north India, which carried the waters of Yamuna to the orchards of Hansi (Haryana) and additionally provided irrigation to the limited cultivated areas in what are today known as Karnal, Rohtak, Hissar and Jind districts in the state of Haryana. The use of canal for irrigation got impetus during the time of Sher Shah Suri and later, during reign of Akbar (1556-1605) in the vicinities of Delhi but the proportion of areas which might have been irrigation relative to that watered by wells was minimal. The salty patches in the soil, said to have developed due to canal irrigation, disappeared when the canals went into disuse in the year 1750, after the fall of Mughal Empire. In the primitive system of well irrigation, there was no appreciable increase in saline-alkali (*reh* or *usar*) lands. The western Yamuna canal was commissioned in 1821, and reopened in 1839. The construction of the Eastern Yamuna Canal was began in 1820 and was opened in 1830. The Ganges canal was commissioned in 1855.

Alarmed by the progressive deterioration of the land fed by the Western Yamuna Canal, the then Government of Punjab felt it necessary for the first time in 1858 to draw the attention of the then Governor-General to the seriousness of the

problem of *reh* or *usar* tracts. The Chief Commissioner of Punjab reported, "For sometime past, it has been known that manyvillages on the banks of this canal in the Panipat, Delhi and Rohtak districts have been sufferring from a destructive saline efflorescence. The eccounts of poverty in some of these villages have been quite distressing, At present, about 60 villages or one tenth of the total number of canal villages, are affected. The mischief is increasing yearly and it will soon attain a very considerable proportion and entail a fiscal loss to the government and great suffering to the people" (Whitcomb, 1971).

A petition was made in 1876, by David Roberts, an indigo planter at Sikandrau in the Aligarh district of Uttar Pradesh, to the Board of Revenue for relief on the grounds that his lands, in many parts of Meerut, Aligarh and the Kali Nadi valley had deteriorated fast owing to the appearance of saline efflorescence, as a result of the introduction of the Ganges Canal irrigation (Agarwal & Gupta, 1968).

Voelcker (1897) an English Scientist, who toured the country in 1891, found enormous tracts, especially in the plains of north India, affected by salts. According to him, in the North-Western Province (now Uttar Pradesh) alone, the salinity affected area was estimated to cover altogether 10,000-12,000 km^2. In this desolation, the patches of crops stood out, isolated in clumps, some in miserably poor condition like oasis in the salt covered desert around them (Whitcomb, 1971).

Ever since then, the development of irrigated agriculture in the county has been taking place at a much faster rate, especially after 1950-51, the beginning of the era of planned development. During the Sixth Five Year Plan (1980-85), an irrigation potential of 15 mha is hoped to the created through major and medium irrigation projects at an investment of Rs. 12,000 crores. Ultimately, 113 million hectares can be irrigated : 58 mha through major and medium irrigation and 55 mha through minor irrigation. By the end of 1979-80, a potential of about 58 mha has been created.

Irrigation developments and the environment

The inadequate development of irrigation facilities at the project level and the poor water management at the farm level have been responsible for the large wastage of irrigation water, the low crop yield, waterlogging, salinity and alkalinity,

and also various environmental hazards. The letest estimates show that 51% of India's agricultural land (173.3) is endangered by erosion, waterlogging or salinity, according to the agriculture committee of the FAO. The various environmental hazards caused by the salt affected soils include patchy or no support of vegetation leading to soil erosion, increase in the concentration of Co_2 in environment due to lack of plants supported by the barren soils, stagnation of rain water due to very poor water intake capacity of the alkali soils resulting in the rise of several mosquitoes and insects responsible for polluting the environment and spread of diseases; and causing floods due to lack of proper utilisation of rain waters. The floods in turn again cause several environmental hazards. It can be realised therefore that indiscriminate developmental planning in the field of irrigated agriculture has harmed the environment. Although the occurrence of *reh* or *usar* soils in India may be traced back and linked with the introduction of canal irrigation, but the latter has not been accepted as the sole and absolute cause for the formation of such soils. However, it has been certainly responsible in accentuating the formation saline-alkali lands.

Extent of the problem

The distribution of salt affected soils in India is quite extensive occuring in almost all climatic Zones. It is estimated that in India alone, about fifteen million hectares of the land have been affected by salt affected soils out of which about five million hactares are comprised by the alkali land in the otherwise most productive Indo-Gangetic plains in the north India.

Reclamation of 'alkali lands and the protection of the environment

About five million hectares of alkali lands, lying barren of producing little, can now be reclaimed by adoption of the technology evolved by CSSRI, Karnal for the reclamation of alkali soils. The work of reclamation is already catching speed in the states of Haryana, Punjab and Uttar-Pradesh through different land reclamation corporations. The main components of reclamation consist of proper land development, proper utilisation of rain water, provision for rain drainage, use of chemical amendments alongwith fertilisers and micro-nutrients and growing of salt tolerant crops like rice and wheat Some grasses (Karnal grass, para grass, bermuda grass) and trees (Eucalyptus hybrid, Prosopis juliflora, Acacia nilotica can also be grown without or with small amount of amendments and fertilisers

(Dargan et al. 1982).

Reclamation of alkali lands leads to increased production of cereals thus solving the food problem of the country in which the population has been continually rising. It supports crop growth and other types of vegetation viz. forage grasses and trees. The crop growth tends to reduce Co_2 and increase O_2 concentration of the atmosphere thus protecting the environment The production of forage grasses leads to increased production of milk through healthy grazing of milch cattle. By growing trees on salt affected soils, with minimum inputs, it helps solve the energy problem of the country. The cultivation of barren alkali lands prevents the stagnation of rain water and checks the occurance of floods. This in turn prevents the birth of several types of mosquitoes and insects which give rise to the several diseases including malaria. Ever since the reclamation of alkali lands has begun progressing speedily in and around Karnal, it is interesting to note that incidence of malaria has been falling fast. Reclamation of alkali lands therefore, helps in the preservation of the environment and for this reason this programme should be enforced in practice with more vigour and zeal than ever before.

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Application of Aerial and Satellite Remote Sensing for Environmental Studies

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Honourable Chairman, Honourable Chief Guest, distinguished delegates, ladies and gentleman. I feel honoured to address this august gathering on the World Environment Day and I am very thankful to the organisers of the Conference on Environmental Conservation and Enrichment in general and to Dr. Vijay Shankar, Head, Department of Botany, Gurukul Kangri Vishwavidyalaya in particular who offered me this opportunity.

The topic I have to speak is 'Application of Aerial and Satellite Remote Sensing for Environmental Studies'. I will try my best to explain the topic in simple terms. Before I enter into the remote sensing applications, it would be worth starting with a brief note on the environment in general.

Environment

Environment includes plants, animals, microflora, soil, air, water, minerals and mitals, man-made features and the man itself. Man cannot be happy unless all other components of enviroment around him are in harmony with each other and also in harmony with man. Though man has no control on many phenomena in nature, most of the present day environmental problems are mainly the creation of man. Nature has a limited capacity to take care of the imbalance created in any of its components but when that limit is crossed the environment is no more conducive for the survival of man. The rate at which the environment is being degraded, it is no wonder to imagine 'Ecological Explosion' that is a situation when nature/environment is hostile to man. Therefore man has to not only preserve but, more rightly, enrich the environment in its own interest.

The main reasons behind the environment degradation are the hurried efforts for economic development where very law priority has been given to environmental considerations. On the other hand, 'environmental statusquo' should not be advocated since poverty is the worst form of

environmental pollution. At the same time healthy environment and economic advancement are not conflicting with each other. A good/healthy environment can, in most of the cases, supplement the economic well being in the long run. For example maintaining a good forest in the river catchment (contrary to the indiscriminate forest felling) will yield more forest produce, will conserve soil, accelerate the process of soil formation, recharge ground-water, reduce flash flood in the river and yield less sediments resulting in longer economic life of hydel schemes. The overall economic gain in the above process is much more than what can be made from indiscriminate forest felling i. e. higher yield for a few years. Therefore Mr. M. Talba, the Executive Director UNEP, has rightly stated that degraded environment is the main cause of poverty and poor quality of living in the developing countries. However there is no quick remedy to environmental degradation. Public awarenes and under standing together with sound decision making, based on facts and figures, by the Govt. machinery can help in improving the situation towards this end.

Remote Sensing

Remote Sensing is the process of detecting objects and events without being in direct contact. Aerial remote sensing may be stated as recording the state of objects and events from aerial platforms such as aircrafts, baloons and helicopters. However most commonly the aircrafts are used as the platforms for aerial photographs which when viewed through a particular type of instrument (called stereoscope) present three dimensional views of the ground features. Satellite remote sensing is that where satellites are used as the platform. Multispectral scanners are most commonly used sensors and magnetic tapes are used as the base for recording data. Contrary to the aerial remote sensing, where films and magnetic tapes (base for recording data) are loaded in the air craft itself, satellites only send signals to the ground stations (earth stations) where the data is received and recorded. Once the satellite is launched in its orbit, the data collection process is continuous for the life of the satellite. Every spot on the earth that comes in the field of view of the satellite, while it is in orbit, is recorded a-t-a specific time interval regularly where as in case of aerial remote sensing the aircraft can be flown when it is desired berring the weather limitations.

Remote Sensing Applications

Because of the above stated nature of data collection, recording of data is free of human bias and recorded data has the capability of multi-stage (data recorded at various stage of development of an event

or an object) analysis. The above stated aspects may be explained through an example as follows : In respect of forest plantation, if it is required to know (i) what was the landuse of the area before plantation (ii) how much area was planted (iii)what is the area under plantationat the time of investigation of all these aspects is possible through etc. the study remotely sensed data provided the same is available for every stage. Same is the case for encroachment of urban areas. Expansion of a city can be monitored withtime through remote sensing. The technique has been used to monitor irrigation schemes both in catchment and command areas. Extent of area under submergence, state of erosion in the catchment, net area, under irrigation, problems and progress of waterlogging leading to salinity and alkalinity have been studied using remote sensing technique. Therefore it may be summarised that benchmark studies (evaluation of state of affairs at a particular point of time) and subsequent monitoring operations can be taken up through remote sensing techniques and the appropriate use will substantially improve the management decisions.

For creating awareness among the people and also for making the people realise the magnitude of degradation in respect of environment, remotely sensed data can play a vital role. Seeing is believing. Since the state of affair and physical conditions of land and water environment can be faithfully recorded in the remotely sensed data products, these products should be extensively used in the public awareness programmes. For example, people participating in any awareness programme can be shown the thick forest of Himalayas in past and the present state of degradation. The evils resulting from the degraded environment can also be displayed to the people for arousing their concern.

Conclusion

I would like to share my happiness with this audience that Aerial and Satellite Remote Sensing is increasingly being used for environemental studies. Our country is almost at par with many developed nations in respect of remote sensing data collection and its application. Thanks to the scientists of the Department of Space, Govt. of India, for prov:ng their capabilities in space sciences by successfull design and launching of satellites. This has already earned a proud place for India on international forums for space sciences. At the same time people in the country are by and large more conscious of their environment and this makes me to believe that good days are ahead. With this optimistic note I once again thank all of you for giving me a patient hearing. I once again thank the organisers for giving me this opportunity.

A Preliminary study of the Ganges Water Pollution at Jwalapur (Hardwar).

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AIMS AND OBJECTIVES

The study was started with the following objectives.

(1) To study the pollution of river Ganges with special reference to the level of pollution at bathing ghats.

(2) To study the pollution of river Ganges at bathing ghats caused by disposal of untreated Nala and drainage.

METHODS AND MATERIAL

Sampling points

To study the points of maximum discharge of Nala and drainage and the peak period of discharge in the river the following sampling points were selected.

(*a*) *River Ganga before it entered Jawalapur :* Points of sample collection were Ram Nagar bridge, Vanpresth Ashram ghat, Gurukula Kangri ghat, Jagu ghat; Mahavidyalaya ghat, Kasai ghat and Jatwara bridge.

(*b*) *Sampling frequency :* Water samples from all these points and Nala outlets spread along the bathing Kasai ghat were drawn almost all the year fortnightly except July-September because the ghats and Nala were flooded and dilution of discharge during these months was very high.

(*c*) *Sampling Time :* Greatest discharge was observad during morning between 7-10 AM. This was also the time when there was maximum activity at the ghats. The sampling time was, therefore, fixed between 8-10 AM In the absence of the automatic sampler, no comosite samples for the whole day could be examined. Only grab samples were collected between the schedule on the fixed days.

(*d*) *Technique of collection of sample :*

(i) The water samples from the bathing ghats were collected at the depth of 0.5 meters. The reason for the collection of sample near the bank was to

find the quality of water near the point where there was maximum human activity like bathing and collection of for drinking.

(ii) Sample were collected in clean glass bottles or plastic containers. The containers were held from the bottom, dipped upside down at the required depth and turned untill the neck pointed slightly upwards, the mouth being directed towards the current of water oxygen was fixed on the spot by adding magnus sulphate and alkaline potassium iodide solution

(iii) All the samples were transported immediately to the laboratory and stored at 10-15°C. Processing of the samples was started within 2 hrs of collection. The samples for bacteriological isolation were alkaline after adding 4% NaOH to bring the pH to more than 8.

(iv) The water samples were filtered though these separate filters prepared by filtering 500 ml of 0 5% solution through Whatman no. 1 filter paper. Through filter paper in funnel 500 ml of sample was filtered. Final identification was done by special tests.

OBSERVATIONS/RESULTS

(1) Physical characteristics of the Ganges water at Jawalapur bathing ghats.

(a) pH—The mean pH values of river water ranged between 7.2-7.4 at different ghats with a range of single reading 6.8-7.7 during various months. Thus the pH did not show much variation from ghat to ghat.

Ideally the pH of swimming water should be same as which is about 7.4. On the other hand, a neutral pH is highly suitable for bacterial growth variations due to acidic or alkaline affecting bacterial multiplication. The mean pH of the Nala discharge at different points during various months ranged between 7.2-7 6 and thus did not cause any change in pH of river water.

Temperature--The temperature of river water varied from 10°C to 28°C during different months. The temperature variation was seasonal. The mean temperature of river water was between 10°C to 12°C during winter months and 25°C to 28°C during summer months.

The temperature of Nala discharge was also within 12°C to 28°C during various months.

Within the temperature range of 20°C

28°C man can function comfortably over long period of time for recreation. The value of 28°C is the maximum for summer, beyond which undesirable physiological effects are produced. The observed value of temperature of river water are therefore within the physiological requirements.

(*c*) *Turbidity*— Turbidity of water at bathing ghats is not changed appreciably on account of Nala discharge expect occasionally and whenever it is so its effect is confined to a river affecting one or two ghats only.

2. Chemical characteristics of the Ganga water at bathing ghats

The median values of total solids at different ghats ranged between 270-400 mg/1 for all months. The variation were observed during winter months only. The total solid values of river water at different ghats during different months fluctuated with a narrow range only. However, on some occasions the values were very high and these were mostly associated with high turbidity values of river water but independent of Nala discharge except once at one of the ghats when high total solids in Nala discharge seemed to influence the water quality.

The median to total solid values of Nala discharge ranged between 67.0 mg/1 to 1400 mg/1 and thus it was two times higher than the median values of total solids of water.

(*1*) *Total hardness*—The total hardness of river water ranged batween 50-230mg/1 at different ghats. No definite trend in total hardness values was observed for winter and summer months.

Highest mean hardness value was observed at Kasai ghat. The values observed show that the hardness of water at different ghats were within the limits satisfying even the drinking water standards.

Mean value of the total hardness of Nala discharge was between 170-230 mg/1 Although, these values were higher that the values of river water, they were also within the permissible limits.

(*2*) *Chloride*—The mean chloride values of river water at different ghats were between 10mg to 17mg per litre. The mean Chloride values of water were higher during summer months than in winter.

It may be concluded that although the Chloride values of river water were within the recommended limits at all ghats. The

pollution was higher at Kasai ghat.

(3) *Free and Saline Ammonia*— The mean values of free and saline Ammonia ranged between 0.001 mg to 0.08 mg per litre at different ghats. Out of several samples examined at each ghat free and saline ammonia were found once during this summer only.

Normally the river water should contain very little to almost nil free and saline ammonia.

However, the pollution was marginal only at most of the ghats except Kasai Ghat. Although the Nala contained sufficiently high free and saline ammonia to cause river water pollution but on account of good dilution present in rivers the effect was minimised.

(4) *Nitrite Nitrogen :* The mean nitrite nitrogen value ranged between nil to 0.2 mg/1. Highest single value of nitrite nitrogen was recorded at Kasai ghat 0.2 mg/1.

(5) *Nitrate Nitrogen :* The range of mean nitrate nitrogen values of various ghats was 0.003 mg/1 to 0.04 mg/1 during different months. The single highest reading of nitrate nitrogen were also recorded at Kashi ghat while not much difference was observed in the valves of nitrate nitrogen during summer and winter seasons.

CONCLUSION

On the basis of above recorded observations it has been inferred that there was definite indication of pollution of river water at Kasai ghat. Pollution was higher during summer than winter.

The results of the study highlighted the following :—

(a) The temperature, pH and total hardness did not show any change except on account of Nala discharge.

(b) Total solids and turbidity also did not show any change except occasionally on account of Nala discharge.

(c) Chlorides, free and saline ammonia nitrite and nitrate found at Kasai ghat Jwalapur show that pollution was taking place there.

(d) The summer values for indicator of pollution were higher than winter values.

(e) The pollution level was however within the permissible limits during both the winter and summer.

On the basis of the measurements and results it was found that the pollution level of Kasai ghat is very high in the summer therefore, the people are advised not to use the river water for their domestic need and it is not even fit for bathing.

Table for physico-chemical characteristics of the Ganga water at various bathing ghats at Jawalapur (Hardwar).

S.No.	Sampling points	pH	Temp. °C	Hardness mg/1	Chloride mg/1	Free and Saline Ammonia mg/1	Nitrite mg/1	Nitrate mg/1
1.	Ram Nagar	7.2-7.4	10-28	50-80	10-12	0.001–0.05	Nil	0.003-0.005
2.	Vanprastha Ashram ghat	7.2-7.4	10-28	60-80	10-12	0 001-0.05	Nil	0 003-0.005
3.	Gurukula Kangri ghat	7.2-7.4	11-29	60-80	10-12	0.001-0.05	Nil	0.003-0.005
4.	Jaggu ghat	7.2-7.4	10-28	100-150	10-12	0.001-0.05	Nil	0.009-0.01
5.	Gurukula Mahavidya-laya ghat	7.2-7.4	10-28	60-80	10-12	0.001-0.05	Nit	0.003-0 005
6.	Kasai ghat	7.1-7.4	12-30	170-230	15-17	0.05 -0.08	0.2 mg/1	0 02 -0.04
7.	Jatwara bridge	7.2–7.4	11-29	150-200	13-15	0.01 -0.06	0.1 mg/1	0.01 -0.02

When development planning harms environment

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Environment and development planning are both natural and human factors respectively, which contribute to human welfare. The environment is highly precious for human life. It is the asset of the earth. The very survival of the mankind depends upon the conservation of the environment which is consisted of many physical resources. These physical resources are utilised in the exercise of developmental planning.

Every programme of developmental planning, in course, affects the physical resources of a region in a positive and negative way. Since our developmental programmes have the sole goal of multiplication of wealth, development of human being is given secondary significance. The resources are utilised without taking into account the broad respective of environmental setting of the region.

An environmental system is an aggregation of a number of physical resourses which ultimately make a unit conducive for human life. If that comprehensive, integrative system is disturbed, by economic development programmes of inadequate foresight, the environment of that region gets deteriorated.

In India economic planning has been implemented since 1946. The Five Year Planning era started in 1951. After 3 such Five Year Plans, again we shifted to one year plans. After 3 such plans we have shifted to five year plans now. During this period of 30 years, a variety of approaches were adhered to by the planners of India.

The Community Development approach was adopted in 1952. After 10 years it was realised that the sectoral development was doing more harm than good. Integrated area development programme (IADP) was put into operation for regional development, but the regions accepted as

planning units were administrative units rather than natural ones.

Districts were taken as planning units. But it resulted into similar defective use of resources.

In this entire planning exercise the main defect accured was that the developmental programmes were focussed on using the particular resources sectorally. This was almost locational planning. Some experiments, when farted, indicated that the resource utilisation was negative from the view point of the welfare of the mankind. The exercises did not achieve the goal of regional development.

Examples are many. Normally, dams are the monuments of the developmental efforts. However, studies of the Aswan dam (Egypt) and 16 dams in India have that shown the projects have failed to deliver the goods The ecology in these basins has drastically changed. Sitting is found to be 2.17 times more than that was expected. The Panshet (Khadakwasala) dam at Pune and the Kali project in Karnataka now possess man-made deserts. The forest cover in the Himalayas is fast retreating. There is only 17.5% forest area in UP (per capita forest 0.05 hectare)

Many, shortsighted irrigation projects in Maharashtra have increased the salinity of the soil. Soils along Bhima and Krishna are fast deteriorating. The cropping pattern in this has been undergoing a change and creating intra-regional imbalance. Birds have changed their migratory routes. The establishment of Zuari Chemical complex in Goa has occupied small area of the plateau. But it has polluted air and water. It has caused deporestation of the entire plateau and done a great harm to the Panaji-environment.

Many irrigation projects in Maharashtra on bank of the river basin, are creating ecological imbalance in the same basin between two sides. A number of examples can be sighted to show that the piecemeal planning efforts have created complications in the conservation of the environment. It should not be the equation that dam and road-development is always a cause of progress. Sometimes it is advisable not to construct roads and dams to allow proper and desirable economic and human development. Such a situation is possible if the developmental planning is attempted taking entire river basin as a planning unit.

Metallic Pollution–A Threat to Life

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Most of the metals are found only in small amounts in our living environment. But, today, the amount of few metals like arsenic, antimony, berylium, cobalt, chromium, cadmium, lead, manganese, mercury, molybdenum, nickel and tin is increasing due to their use in various forms in industries, agricultural field, cosmetics, household usage, food processing and medicines. Of these metals cadmium, lead, mercury, manganese, nickel and chromium are of major concern in our daily life. The increase in the concentration of these toxic metals in the environment has posed a threat to human health by producing toxic effects on entering its body. Toxic metals are dispersed in the environment through industrial effluents, organic wastes, refuse burning, transport and power generation. Besides this, erosion of earth, forest fires and volcanic activity are some of the natural causes of environmental pollution.

The problem of metallic pollution and metal toxication is universal. But, the situation is serious in developing countries like India. The Bulletin of Mineral Statistics and Information has revealed that in India, localized deposits of iron, manganese, aluminium, lead, cadmium and zinc are being moblished and made available for dispersal in the environment. On the one hand, these metals are of great importance in socio-economic development of the country, but on the other hand inhalation of these metals at enhanced levels has adverse physiclcgical effects cn the health of people.

EFFECTS

Cadmium

Cadmium is obtained as a byproduct from the refining of zinc, copper and lead. It is being used in a number of industries for the purpose of elecro-plating, in the manufacture of paints, as a stabiliser in plastics, automobile radiators and as electrode component in alkaline accumulators. Cadmium content has been reported in food-stuffs. The drinking water becomes polluted as a result of leaching from solders

containing the metal in fittings of water heaters, coolers and taps. The use of sewage sludge and superphosphate fertilizers leads to contamination of the soil from where it is taken up by plants.

Cadmium poisoning inhibits several enzymes in human body. The symptoms are vomiting, abdominal cramps and headache. Its inhalation causes difficult breath, and general weakness. Chronic exposure to cadmium results in liver damage, respiratory disorders, kidney damage, anaemia and hypertension. In most of the animals like rats, cats and dogs cadmium chloride has been reported to cause setrilization with the degeneration of germinal elements. It inhibits corbohydrate metabolism in air-breathing and non air-breathing fishes. Besides this, it lowers the total protein contents of the chironomid larvae, thereby diminishing their nutritive values as fish-food. Excessive exposure of cadmium may also result in the death of larvae.

Lead

Lead smelting and refining are the most hazardous operations for exposure of lead. It is extensively used in manufacture of paints, water pipes, batteries, pottery soldering operations and as an antiknock agent in gasoline. Lead is present in various food-stuffs of vegetable and animal origin. It has also been observed that usually raw food material do not contain lead. But appreciable amounts can be found after being cooked with ghee, oil, salt and spices. Surma and red lead applied by Indian women may also lead to poisoning. The colour coating on the surfaces of pencil contains lead based paints which chewed by children may be cause of lead toxicity in them. The lead content has also been reported in tea samples and acidic beverages stored in glazed pottery.

Lead poisoning shows different clinical syndromes of illness in man. It causes anaemia at early stage of poisoning. The acute poison causes abdominal colic and acute encephalopathy. A peripheral neuropathy is also common feature. Chronic exposure causes convulsive seizures, severe nervous depression and even death also. In animals, lead nitrate has been found to cause loss of weight, rise in body temperature, haemoglobinaemia and hematuria. It also produces powerful spasm of smooth muscles. High concentration causes anaemia and enlargement of red blood corupscles.

Manganese

The commercial source of this metal is pyrolusite ($Mn O^2$). The amount of this

metal is increasing with the growth of steel industries. It is being widely used in electrodes coating, in welding rods, in fluxes for iron and steel, in manufacturing pigments, paints, ceramics, photgraphic marerial, wood preservative, fertilizers, as a polarizer in dry cell batteries; and as additives in gasoline and fuel oil. Manganese dioxide is also added as drier to linseed and other oil seeds. The workers in such industries are exposed to the dust and fumes of this metal. Poisoning has also been reported in the people consuming water with high manganese content.

Manganese is absorbed either through the respiratory tract which is a major route or through gasteriointestinal system. The absorption causes neurological syndrome resembling Parkinson's disease. There is a significant increase in serum calcium and adenosine deaminase levels. Further, it results in asthenia, somnolence, imbalance while walking, slurred speech, difficulty in fine movements, and impotency. It also shows symptoms of tremors in body, parasthesias, memory loss, difficulty in swallowing and masked face. In animals acute toxic effects of manganese have shown neural changes in the cerebral and cerebellar cortez of the brain. The animals develop paralysis of hind limbs. A marked reducation occurs in the acid phosphetase and adenosine triphosphatase activity in the degenerated neurons. These changes are responsible for the neurological signs in the animals. In cerebrospinal fluid, there is a marked reduction In the concentration of albumin, globulins and certain enzymes. Manganese dioxide administered intratracheally to rabbits, produces destruction and calcification of the seminiferous tubules. But the brain is effected earlier than the testis. Lungs show thick fibrosis comprising of retculin and collagen fibres. Iron deficient animals accumulate more manganese in their liver, kidney and testis.

Mercury

Mercury is found in the form of sulfides in the earth's crust. It is used in chlor-alkali plants, in electrical equipments, in paints, in thermometers, in sphygnomanometers, in dental practice and in agriculture. Methyl and ethyl mercury have been extensively used in seed dressings. Mercury dispersed into the environment during its production and by human activities like combustion of fossil fuels, waste disposal and industrial activities. Mercury is also discharged into waterways by some industries.

Both organic and inorganic salts are prominent toxicants. They mainly affect brain and kidney. They are also embrotoxic and mutagenic. Minamata disease in Japan

is caused by taking mathyl mercury contaminated fishes. The poisoning also causes respiratory inflammation, gastric trouble, nausea, vomiting and sometimes even death also. Experiments on rats have shown that it causes severe damage to the renal tissue, inhibits synthesis and accelerates degration of L-ascorbic acid. The Chronic effect of mercuric chloride intoxication has been reported in digestive system of fish, *Channa punctatus*. The acid and alkaline phosphatase activity is inhibited. There also occurs liver cirrohsis and glycogen depletion. The gastric glands degenerate and villi of intestine rupture.

Nickel and Chromium

Nickel and Chromium are extensively used in industries of electroplating, polishing, paints and pigments. The workers of above industries and loaders transporters of cement become affected.

The urine excretion of affected persons was found to contain high content of chromium and nickel. The poisoning is more due to skin contact. The workers engaged in electroplating develop allergic eczematous dermatitis. The animals exposed to nickel show a significant increase in level of blood sugar, serum cholestrol and total phospholipids. The skin of nickel-painted rats develop hyperkeratinization, vacuolisation hydropic degeneration of basel layer and oedema of seminiferous tubules. The maximum accumulation of metal occurs in liver and kidney followed by testis, brain and blood. Freshwater teleosts develop leucopenia when exposed to nickel and chromium.

REMEDIES

Industries using toxic metals should use appropriate methods for the disposal of their industrial smoke. Metals present in the effluents and smoke should be recycled and reused, which would minimise the dispersal of metals into environment and it would be of great help in stabilising the economy of the country. Definite standard permissible limits for dispersal of metals and discharge of effluents should be worked out. Social, cultural, economic and nutritional status should be taken into account for setting the standards. The environmental engineers and hygienists should be consulted to keep standard permissble limits of metals in the environment. These standards should be strictly implemented by relevant legislation. The workers in different industries should be acquainted with the possible ill-effects of toxic metals to which they are exposed. They should be taught to use protective glasses, masks and clothes to escape from exposure to metals.

The household usage of metals should be minimised. Epidemiological studies should be made to find out the dose response and does effect data for toxic metals on human beings. There is a need to develop simple diagnostic methods for the early detection of exposure to metals Suitable animal models should be developed to find out the effects of interactions of various toxic metal. Proper therapeutic agents should be worked out so that the essential metallic elements are not removed along with the toxic ones. Besides this, information on toxicity of metals on lower organisms and plants would also be of great value in providing information for human health. The ultimate solution to avoid the adverse effects of metals upon our life lies in keeping all the exposures minimum and it should not exceed permissible limit standards.

The Controversial Eucalyptus

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INTRODUCTION

Eucalyptus, the most popular and controversial tree belongs to the family Myrtaceae. The family which includes a number of aromatic plants. *Eucalyptus* is a native Australia (Bentham and Mueller, 1866; Bailey, 1953), There are about 600 species of *Eucalyptus* found acclimated to the diverse geogrophical and eco-climatological regions all over the world. The most popular species include *E. globulus, E. grandis, E. tereticornis, E. citriodora, E. hybrid, E. cameldulensis, E melanopholia, E microtheca, E. patentinervis, E. crebra, E. hemipholia, E. multiflora*. and *E. peniculata* etc. (Mathur, 1960). This tree reproduces naturally by seeds. Its vegetative reproduction by cuttings bearing juvenile foliage has been successfully achieved in Russia. Australia and many parts of the Africa. Maheshwari and Saxena (1971) have given very useful keys of identification of about 95 species most commonly grown in India.

In their native forests of Australia this tree attains giant height of 400-500 feet with a girth of about 90-95 feet at the base. Its leaves are usually alternate, simple, shortly petioled and usually evergreen. The plants are remarkable for their rapid growth, long life and are among the tallest trees of the world. These are the popular gum trees in Australia although the exudation is not a gum, but a tanniferous substance called 'kino'.

Eucalyptus in India : Eucalyptus was introduced in Indian in 1843, by Captain Cook in the Nilgeeri hills of Ooty (South India), mainly to supplement the then growing fuel requirements, as it grows rapidly. From there is gradually spread to Mysore and ultimately in the whole Indian subcontinent. Its spread is remarkable specially during the past 25 years. And it has attained a specific popularity (Mathew, 1967), even among the common farmers all over the country. About one hundred species have been tried in India, out of which 37 species have been described from South India (Menon and Kuppuswamy,

1957) so far, and many of them are under cultivation. In India it is mainly being grown for its paper industry based commercial uses. And mainly nursery raised seedlings are extensively used for vide spread cultivation of the *Eucalyptus*.

ROLE OF EUCALYPTUS

The *Eucalyptus* is extremely ornamental aromatic evergreen tree. It is rarely shruby indigenous to Australia (Mathur, 1960). The diverse specis of this genus find equally varied role under various kinds of geographical regions, all over the world.

Interestingly enough, while in India the *Eucalyptus* is regarded as a soil drier Bahuguna, 1983), on the other hand, it is extensively and exclusively used for water conservation (Mathur, 1983) in some regions of Australia (Brisbane). According to some workers *Eucalyptus globulus* uses 3475 tonnes of water per hectare i.e about 35 cm. of 130 cm. of rainfall in the Ootcamand (Thomas, 1972 cited by Mathur, 1983) while the potato use 65 cm. of rainfall. Thus accordingly, *Eucalyptus* allows more water to reach to the ground level so as to enrich the subsoil water reserves, as compared to the trees of Sal, Chir, Teak, etc. In fact it has been reported that Eucalyptus, Sal, Chir, Teak, Acacia and Chatian forests allow 90, 75, 78, 80, 72 and 74 per cent of the rainfall to reach ground level, respectively.

From the above cited results it appears that *Eucalyptus* allow more water to reach to the ground level; but opponents of the Eucalyptus have to say just contrary of it on the same grounds. They point out that since *Eucalyptus* foliages do not put any significant resistance to the falling rains and its stem and trunk also do not absorb more water hence the rain fall directly collides with the soil surface and causes more soil erosion than in other broad leaved tree forests or thick barked tree forests. Similarly according to an another report *Eucalyptus* is one of the most thirsty trees of the plant kingdom. As a single fully grown tree may transpire as much as upto 80 gallons of water per day. In some parts of Israel the tree is used to dry up the swampy or water logged land, and that if the springs in any given forest area (of this trees) dry up, then the *Eucalyptus* trees in that area are felled down, as a result the water level in the springs rises up.

Sri Sunder Lal Bahuguna (1983) the noted Chipko pioneeer of our country, is of strong view that *Eucalyptus* is causing severe damage to our ecology as well as climate, in the regions where it has grossly replaced the traditional broad leaved

forest belts, specially so in Terai and Bhabar regions of U.P. Bahuguna has said it more than once that the cause of fall in humidity in the Terai region and cause of now reaching hot air blows to the Himalayan districts of U.P. and rapidly receding glaciers like Pinder in Himalayas lie mainly in the blind cultivation of the Eucalyptus forests, in the foothills of the Himalayas. However, we must also not forget that fall in the humidity may also be caused or at least inhanced by a rapid rate of deforestation in the Himalayan hill pockets, besides other factors like increased petro end products and CO_2 contents of the air.

Equally controversial is the mono-culture propaganda in favour of the *Eucalyptus*. We are certain about the fact that development of healthy forests can take place mainly under composite or polyculture programmes of afforestations. Monoculture appears to be basically against the natural forest policy and forest growth laws. As it is also voiced from certain quarters that Eucalyptus does inhibit the under growth, thus a certain stratification is inhibited (we humbly opine that this is due to its characteristic aroma). Though this concept has also been refuted from the studies obtained from the F.R.I. Dehradun (Mathur, 1983).

But it has been generally observed that stretches of newly created *Eucalyptus* forests, certainly, do not attract as diverse wild fauna as other mixed forests. To elaborate more on this point we shall like to invite the attention of those, who may be interested, that in the Shyampur forests range about 8–10 km. away from Hardwar-in way to Najeebabad–there is a very dense forest of the *Eucalyptus*, stretched in an approximate area of about 10-12 sq. km, on one hand and just in front of the same in the aforesaid forest range–exists the traditional mixed broad leaved forest. While the latter provides more than thousands of floral species diversity, the former is able to allow to grow nearly hundred and odd species of plants, below it, even at the most superficial visual level. This goes against the basic concepts of long tern eco-planning. Diversity in the biotic community is very essential for the proper sustenance of the local eco-climate and the forest floor. Similarly according to some workers *Eucalyptus* is said to drain a lot of soil nutrients for its rapid growth while not adding much to the soil through the decomposition and recycling of organic matter, in due course.

Simultaneously Penfold & Wilis (1961) reported that some species of the *Eucalyptus* are among the best honey

plants of the world, but our field observations are contrary to it and more in agreement to those of Bahuguna (1983), that aromatic species of the *Eucalyptus* do not encourage the bee swarms.

ECONOMIC IMPORTANCE OF EUCALYPTUS

No doubt the *Eucalyptus* has gathered a lot of controversy during past one or two decades. But no one can deny of its myriad ecological and economical roles, in present day industrialized world. *Eucalyptus* offers a variety of commercial and industrial uses. It is one of the major raw material in paper industry, used in construction of building as accessory supporting timber, also used (though not preferred) as house-hold fuel by the common man. It grows rapidly and gives good cash return say within 7-8 years. Its market cost is said to vary between Rs. 70/00 per quintal to Rs. 400/00 per ton as the demand and supply may vary. But it has thus some negativity to acquire. That while a large number of big farmers go for its cultivation the small farmers and the farm labourers are deprived of their routine farm labour based jobs and earnings.

The tree also has a lot of ornamental and aesthetic value. The large, tall and elegant beautiful trees oozing out a pungent and lovingly pleasant aroma has acquired a place for it in the beautification of the gardens, lawns, roadsides etc. Besides its aroma is sald air purifier, as a result it has been extensively used in the hospital premises, industrial areas and religious places. On the other hand the leaves, seeds, twigs, bark and even the roots of *Eucalyptus* are well known for their various medicinal uses.

CONCLUSION

Whatever the controversies may be, it is beyond doubt that *Eucalyptus* is a handsome tree with a number of medicinal, aesthetic, industrial and economic as well as ecological roles to play. And presently it has no match or alternative. It is therefore suggested that more research is required on its role, place and better exploitation for an healthier environment and more economic commercial exploitations.

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Some Endangered Plant Species of India

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The wild progenitors of *Cicer arietinum* (gram), *Crotolaria juncea* (sunn-hemp), *Cyamopsis tetragonoloba* (guar) *Gossypium arboreum* (Asiatic tree-cotton), *Corchorus capsularis* (jute) *Zingiber officinale* (ginger), *Polianthes tuberosa* (tuberose), *Sesamum indicum* (sesame), and *Cymbopogon citratus* (lemon grass or Agya Ghas) are no more known (Maheshwari, 1978). It is a well known fact that many plant species have become extinct and many others are facing the threat of extinction. The fall in populations of the species of some wild plants has become a matter of deep concern for their vulnerability and needs special attention to save them from sliding into extinction from one or other part of this country. A list of some such plants of different regions of India is given below.

Haryana and Punjab

1. *Ephedra foliata* Boiss, vernacular name Asmania (Gymnosperm). It is an endangered taxon of Haryana, Punjab and adjoining areas of Rajasthan. The plant is of medicinal importance and an old source of drug ephedrine. The causes of vulnerability are, unplanned consolidation of land holdings and clearing of *Salvadora oleoides* and *Prosopis cineraria* forests in district Bhiwani (Kaushik, 1981). Recently the plant was reported from Nehal Khera on Abohar-Fazilka Road in the Punjab (Kaushik, 1979).

2. *Tecomella undulata* Seem, in Hindi Rohira (Bignoniaceae). A small tree of horticultural value, bear large beautiful flowers. Timber-wood useful. Recently have been planted on both sides of the road in sector 16 at Chandigarh. Wild populations termendously vanishing.

3. *Clerodendron phlomoides* L., in Hindi Arni (Verbenaceae). The plant is of medicinal value, bears white, sweet smelling flowers. A victim of unplanned consolidation of land holdings.

4. *Microphyllum spicatum Linn.* (Haloragaceae). Aquatic angiosperm of botanical

interest, has not been recorded outside Patiala district (Sharma, 1973). Usually grow in Kashmir at an altitude of 500-2000 m.

Rajasthan

5. *Calligonum polygonoides* Linn., in Hindi Phog (Polygonaceae). It is facing the threat of extinction in the Rajasthan, is a small leafless shrub. It has been a source of fire-wood in the desert and its flowers are used as food in the form of vegetables. The flowers on cooking are mixed with the curd and form an excellent preparation called 'rayata'. It was a traditional job of the natives to collect the withered flowers and floral parts from the ground below the shrub. Because of the growing shortage of these flowers people continued to pluck and collect unfertilized flowers, hence preventing plants to form seeds and ultimately the populations of the plant in the nature decreased. Author could not collect it in wild state in District Jhunjhnu. A plant was under cultivation in the garden of Education Society, Malsisar (Jhunjhnu). Though still wild in Bikaner.

6. *Commiphora mukul* Engl., in Hindi Gugal (Burseraceae). A plant of medicinal importance, 'gugal' a gum resin exudes from incisions made into the bark in cold season.

Mysore

7. *Amorphophallus campanulatus* Bl., Chane in Kannar, Zimikand in Hindi (Araceae). Large tuberous, tuber 13 cm to large in diameter, pedicel 0.5 to 1.0 m long. Rare in wild state, collected from Balle forest at an altitute of 732 m.

Himalayas, Eastern India and Coastal regions

8. *Entada pursaetha* DC (Mimosaceae). Woody liana, with very large pods. Rare in the Himalayas. Author collected from the Silent Valley in Distt. Palghat (Kerala).

9. *Magnolia griffithii* Hook. f (Magnoliaceae). Is of botanical interest, the populations endemic to upper Assam.

10. *Nardostachys grandiflora* DC, in Hindi Jatamansi (Valerianaceae). Rhizomes are aromatic, rare in the alpine Himalayas and of great medicinal utility.

11. *Nepenthes khasiana* Hook f. (Nepenthaceae). Commonly called pitcher

plant, a climber, insectivorous and is found in thick forests of Meghalaya. Extremely rare.

12. *Rauvolfia serpentina* Linn. in Hindi Sarpgandha (Apocynaceae). Is of great medicinal utility, very rare in wild state and under cultivation.

13. *Rhododendron arboreum*, in Hindi and Tamil Aalingi (Ericaceae). Is of great medicinal and horticultural value. Deforestation is the another cause of rarity.

An international *Rhododendron* conference was held at the New York Botanical Garden in 1978 and the proceedings of the conference were published in 1980. A 'Rhododendron Del' was currently under preparation at the Bronx campus of the New York Botanicel Garden.

14. *Aldrovanda vesiculosa* Linn. Droseraceae). It is of special mention that this monotypic, aquatic and carnivorous plant reported from salt pans near Calcutta is threatened due to reclamation (Jain and Sastry, 1980).

15. Orchids. Virtually the entire family Orchidaceae by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) also ratified by India, has been regarded endangered and will require permit for export (Ayensu and Defilipps, 1981). Kaushik (1983) has given a complete list of endangered orchids which deserve special attention to preserve their ecological nitches. Hegde (1979) discussed orchid conservation with reference to their commercialization and his current publication on the orchids of Arunachal Pradesh is awaited.

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Role of Biological Control of Pests in Reducing Pesticide–Pollution

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A pest is the organism that directly or indirectly interferes with man, his agricultural crops and garden plants. The chief categories of pests include mycoplasmas, bacteria, viruses and other parasites that cause disease in humans or domestic animals and plants. The biting and sucking insects are also included among the pests.

In general the insects dominate in comparison to other pests. Indeed the insects cause much harm to man and his agricultural crops. Destruction is due to their mouth parts, depend upon the morphological nature of the mouth parts. Some insects may suck the cell sap, others may eat the pollen, and the larva destroys the whole plant. Side by side they spread a number of diseases also.

Since long the people used some pesticides for controlling the pests. Inorganic chemicals were used initially. Due to that the natural selection or survival for the fittest takes place. Some individuals of the pest population carry gens, which make them more resistant to the chemical treatment. The exceptionally high reproductive capacity of insects allows the few resistant individuals that survive and gradually being the population back to its original form or size, with which the insect continue the destructive activities. Since all the individuals of the new population are derived from those resistant survivers, so they also carry those genetic traits which show resistance to the chemicals previously used for killing their ancestors. Subsequently the new pesticides (synthetic organic chemicals) were discovered as effective pesticides. That is why synthetic organic chemicals gained popularity to control the pests. But unfortunately these bore undesirable side effect called the 'pesticide-pollution'.

As pointed out earlier, because of natural variation in every population, there are some insects in every population that are genetically more tolerant to the particular chemical that is used ; these insects survive and reproduce offsprings that have

the trait for pesticide tolerance. It is better if the pesticides are applied in larger doses and at more frequent intervals in order to achieve the required killing effect. Due to the high dosage of pesticides the environmental problems have increased. One of the most important problem was "pesticide-pollution".

There are so many examples which show the pesticide pollution which is due to their fat solubility. Consequently the pesticide molecules were rapidly absorbed from the water into the lipids of planktonic organisms. These molecules remained as such. It has been proved experimentally that the fishes commonly swallowed these planktons and the birds as well as ducks ate these fishes. The sub-lethal level of D.D.T. interferes with calcium metabolism in the birds, resulting the formation of extremely thin egg shells in their eggs. Such eggs were found breaking in the nest during incubation.

Now a days pesticide pollution has become a serious problem. To avoid the pesticide pollution biological control of pest came as an alternative. The term biological control is used for the control is used for the control of the pest population by a natural enemy that may be viral, bacterial, a parasite or any insect.

There are several examples to explain these principles and to demonstrate the potential successful biological control by insects.

The cottony-cushion scale insect was first observed in California in 1868. It spread and ruined citrus trees. To control this enemy of citrus trees, a small parasitic fly called the 'lady bird beetle' was imported and released. Consequently the cottony-cushion scale was no longer significant problem there. For the control of plant eating insects with predatory that is praying mantis or long legged praying insect which are some parasitic wasps can be highly effective. Once established the effective natural enemy seeks out and destroys the pest we want to knock out. Biological control has also been used to control the weeds. In addition to insects, various fishes are being tested for control of aquatic weeds.

It has been established in the process of biological pest control. There is no harmful effect to the environment but it helps in reducing pesticide pollution. Of course, it is true that the biological control is rather difficult in comparison to that by

using pesticides. But there is double profit in biological control, that is reducing pesticide pollution and are also economically cheaper.

We can conclude that the potential biological control is much greater than is generally recognised. The advantages include-specificity to the pest, persistance of the control, coevolution of the control so that the pest does not become resistant, and without disturbing the ecological balance. It is certainly true that development of appropriate biological controls require skilled scientists and technical personnel and funds for conducting research.

It is indeed a matter of pleasure that our wise government has set up an independent department of environment. The biological control which at present is even less than 10 per cent of the usage of pesticides will be definitely popular in the years to come, which consequently will safeguard us against the pollution caused by excessive use of chemical or organic synthetic pesticides.

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Environment and the Farmer

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The term 'environment' literally means the surrounding. The environment of an organism consists of physical and biological factors around it which interact with one another and directly or indirectly influence the life of the organism. Accountable physical factors are soil, water, light, temperature and wind which along with the live-factors supported by the physical factors constitute the giant ecosystem of this universe in the language of the modern environmental biologists. The term ecosystem was coined by renowned environmental biologist P. Odum which according to him is the study of structure and function of nature. Innumerable are the smaller units or ecosystems in this giant ecosystem of the universe which does not exclude the study of space even.

It is not in India alone rather all over the world the major human population depends on agriculture for food. Today agriculture constitutes perhaps the biggest artificial or man engineered ecosystem, and a new branch of ecology has sprang up today known as the 'agricultural ecology'. The subject is indeed very important and interesting since the maximum energy of the vast human population is applied to agriculture and our all industrial, socio-economic and political endeavours will remain futile without it.

Western ecologists have done tremendous work on the vegetation of tempeiate zones of the world and now a large number of scientists are busy in their research on the ecological problems of the tropical belts of the world. A few scientists of some countries including from India have also made some interesting ecological observations in the Antarctica, the snow-clad south polar region a latitude of $66\frac{1}{2}°$ S.

India is a great nation with vivid geographic and ecological conditions which perhaps shows maximum diversity of varieties of crops and modes of agricultural patterns starting from the Himalayas to the southern coast including Indian archipelagos in the south, and from the most arid regions of the Rajasthan in the west to the usually flood affected parts of the eastern India. Every year the farmers of this or that state have to see the untoward incidents of of epidemic, destructions of his crcps either by floods or dryness; his crops are

slain by heavy showers, hail storms, strong winds and tornados; which so far have been regarded the curse of God. Vast belts of the land of the farmer is sometimes acquired by the government under so called masterplans either for unrabisation or constructing roads and stretching Railway lines. Floods and the winds not only destroy the standing crops but also cause erosion of the top soil which takes millions and millions of the years in the nature for its formation. Our urban society is dependent on the farmers who usually inhabit the villages some of which with pitiable conditions, unhygienic for living and lack many essential facilities which produce hinderance in their work. Very little does the common urban man think of the environment of the rural areas.

Although our government and sharp brained scientists have not been silent spectators of the countless problems which directly or indirectly bear the deep impact on farmer, his crops and the live stock, yet no permanent and reasonable solution has been found definitely for some of them. Many a problems have been solved which consequently boosted the agricultural production.

We should also remain aware of the artificial fertilizers which may disturb the nutritive balance of the soil and of the pesticides which are spreading pollution.

Our plant breeders have produced some new varieties of cereals which are usually resistant to a particular disease and are adapted to grow in dry lands by hybridizing the traits of the taxan with well developed root system and maximum yielding varieties or contrary to it suitable for the water-lodged lands. The currently observed untimely changes of the environment have at some places made all endeavours of our scientists futile. The reasons for these are being looked into by a board of Indian agricultural scientists and meteorologists under the able direction of our Central Agriculture Minister. Our agricultural ecosystems should not forget the problems of other natural ecosystems. The farmer should also be equally aware about the natural environment around his crops, for example the population of snakes have been much reduced by killings the snakes continuously; this resulted in an increase in the population of rats which do much harm to his crops; he should remember that all snakes are not poisonous Sugar-cane moths are really very harmful. But, instead of using excessive quantity of pesticides he may practise the simple old techniques like keeping a big pan of water on the corners of the sugar cane field and placing a lamp in the centre of the pan on a suitable spot. Since the moths are nocturnal the insects are attracted by the spot of light and get dipped in the water. The method is not only cheaper but also saves the crop and the land from pollution.

Energy crisis-A plea for 'Pedal Power'

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For quite some time now there has been a hectic search for new and renewable sources of energy. The fossil fuels on which we had grown dependent are fast and recklessly being depleted. The reality of the energy crisis hangs perilously not only over developing countries but also over the developed ones. Energy experiences in the world range from the most primary forms as manual labour and animal power to the most advanced use of nuclear and solar energy technology. Impressive quantities of commercial energy are produced from coal, lignite, oil and hydro-electric potential of waterways. Non-commercial sources like firewood, agricultural wastes and animal-dung are also extensively used.

Bullock-carts are referred to as symbols of the past. But do we know that in India animals provide more power than all the power-houses whose installed capacity is 29000 megawatts. Their replacement would entail a further investment of 25 to 40 billion dollars in electricity.

In countries where petroleum is scarce and costly simple technologies should be developed. A case in view is 'Pedal Power' and how human energy can be harnessed through this power for transportation and various other tasks with little or no pollution.

Bicycle technology shows great promise as a reasonable means to help meet goods and human transportation demands in the face of rising petroleum prices, pollution problem, urban congestion and a shortage of motorized vehicles. Stuart W. Wilson of the University of Oxford has pointed out that this technology might be improved. Their replacement by petrol/diesel/gasoline-driven vehicle will add to the already polluted environment.

Extension of bicycle technology to goods transport led to the construction of three-wheeled vehicles which are in current use in India, China, Indonesia, South-east Asia. Some authorities wish to banish them on the grounds of lack of safety, causing congestion and a lack of modern image. To abolish such a useful, low-cost, low energy, low noise and low-pollution

vehicle would deprive the poor and middle classes of a most effective means of trans-port and cause unemployment among drivers and associated traders. Various types of tricycles have established them-selves widely in Asia, though not in Africa or Latin America, although they are fighting a losing battle in some of the bigger cities of Singapore and Jakarta.

Their replacement by petrol/diesel/gasoline-driven vehicles will add to the already polluted environment.

How much power can we expect to be able to supply by pedaling ? Tests of Oxford on a bicycle with a bulit-in dyno-meter confirm that 1/10 horsepower or 75 watt is a reasonable figure for the sustained output of an average rider at a road speed of 12 m p.h. 1/4 horse power or nearly 200 watts is produced at 18 m.p.h., which many riders can achieve at least for a limited time, and upto 1 horsepower or 750 watts is possible for a second or so.

These figures reveal a remarkable overload capacity of the human body—the ability to exert 10 times our normal output when required. The question is how to apply this muscle power to useful ends. In addition to personal transport, as with the usual bicycle, how can we develop the means of helping people to help themselves in other ways by their own efforts without depending on expensive petroleum and without polluting the environment.

Potential uses of pedal power extend beyond the transportation methods just described. With present fossil fuel costs and energy availability problems in both the developed and developing worlds other energy sources must be considered and tested. One such source is as old as mankind itself; human energy as expressed through pedaling. Human energy can be harnessed through pedal power for tasks such as shelling maize, operating a winch as well as a variety of other common tasks that generally require either electric power as a gasoline motor. Pedal power can be mobilized with an apparatus connected to a bicycle which generates electricity. The pedal power apparatus can also be built into the particular machine that it powers which limits it to one function, or it can be built as an independent apparatus and attached to many different devices. An example of such an independent unit is "Prime mover" which uses the basic bicycle design, but the chain driven by the pedals powers a pulley wheel instead of bicycle wheels. The pulley is attached to one end of the drive shaft and a fly wheel is attached to the other. The prime mover

can be attached to any pulley-driven apparatus by using a transmission belt. The prime mover can be attached to saws, pumps, churns, electric generators, hydraulic units and lathes etc.

It is evident that there is considerable potential for the development of more widespread application of stationary pedal power. With the rising cost of fuels and their environment polluting effect, new applications of this technology can be found both in developed and developing countries for a variety of functions in rural areas lacking electric power and for certain tasks in urban areas. A major obstacle to such development, however, is the lack of organizations dedicated to the design of prototypes. There is no incentive for commercial firms to undertake such work. Not insignificantly, the whole idea of solving real problems by simple means rather than by computers—is foreign to most scientists and research engineers. However, the climate of opinion is changing, and there are organizations like the National center for Appropriate Technology, Volunteers in Technical Assistance, and Rodale Press Inc. In several countries where simple technologies are being taken seriously Technological simplicity of pedal power has application for us all.

Another major area of need that can be addressed by stationary pedal power is water pumps. In regions where there is little petroleum available for diesel or gasoline-powered pumps and fuels are prohibitive, human power can be substituted. A foot-powered pump developed by engineers at the international Rice Research Instt. in Phillipines can lift large quantities of water several feet using only moderate amount of labour.

Minimising Environmental Pollution by using Solar Energy

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The term environment generally means the surroundings of an object. To be more specific, the environment consists of physical and biological factors that interact to produce habitats for living organism. The physical factors that constitute the environment are light, heat, air, water, soil, mineral resources and so on, whereas the biological factors consist of plants and animals. The interaction of living organism with the environment is a natural phenomenon and under normal circumstances an ecological balance is maintained. But in the course of developing civilization, man has ignored this basic relationship between living organism and environment and has brought about drastic changes in the ecosystem which has given rise to environmental pollution.

Any undesirable qualitative or quantitative change in physical, chemical or biological characteristics of environment is known as pollution. In other words the term pollution refers to the contamination of soil, water, or the atmosphere that lessen their value to man or other living organism. Due to the adoption of artificial ways of life, man has been responsible for polluting the environment in a big way. Pollution increse with the development of technology and with the increase in population. Due to the negligence shown by man in recycling the materials and his lack of interest in taking antipollution measures, there has been a rapid deterioration in the environment which may adversely affect the ecological balance.

Various conventional sources of energy like coal, wood or oil when burnt give rise to air pollution introducing various undesirable gases like carbon monoxide, carbon dioxide, oxides of sulphur and nitrogen and so on into the atmosphere. Fuel burning either in industries or in automobiles is the biggest source of air pollution.

Air Pollution affects the human health. Some of the respiratory diseases like chronic bronchitis, asthma and tuberculosis are aggravated in polluted air. It is well known fact of hygiene that pure water, air

and food are vital for the maintenance of good health. It is due to this reason that many advanced countries are introducing strict antipollution regulations.

In this context it is now being realised that the use of other energy sources like solar energy, wind energy and tidal energy should be increased. All these sources of energy are pollution free and almost inexhaustible in nature. The solar energy technology has particularly developed during the last few years. There are two basic methods of solar energy conversion. First method is known as photovoltaic energy conversion, in which solar energy is directly converted to electrical energy by using photovoltaic cells (solar cells). The second method is the solar thermal method in which solar energy is collected using flat plate collectors and then the resulting heat energy is utilised for various applications. Recently, solar houses have been built in which all the energy needs are met by solar energy. Solar energy can be used for heating or cooling of buildings.[2] The solar energy has found wide applications from solar cookers to cars driven by solar energy. Solar pumps have now been developed to pump out water for irrigation purposes.

Earlier the solar cells were used mainly in satellites as a source of power. Recently significant amount of research and development work has been carried out to use solar cells for terrestrial applications. At present the only difficulty in using solar cells is that they are very costly. With the development of technology and mass production it will be possible to reduce the cost of solar cells, which can then compete with other conventional sources of energy. Since the solar cells convert solar energy directly into electrical energy, no gases are formed as waste marerial and so there is no question of pollution of any kind. The use of solar energy will therefore be a step towards minimising environmental pollution.

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Himalayan Environment and Resource Planning : An Ecological Assessment

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The Himalayas are an outstanding landmark on the macrocosm, being one of the utmost countenance of world relief with the tallest peaks, tremendous river gorges, and rare flora and fauna associated with the habitat of some of the tallest trees in India. First and foremost these alienate the notion of montane environment where the altitudinal temper discriminates the landscape complex. The terms alpine and sub-alpine have been coined to depict the high mountain environment and to elude jumpling with the latitudinal notions of arctic or sub-arctic; in spite of the ubiquity of snowcovered at both the high altitudes ,inherent differences of daylength and temperature rhythms necessitate their elimination into conspicuous alpine and arctic categories. The altitudinal pattern presents a very wide spectrum in the Himalayas coupled with the vegetational pattern which ranges from rain-forest to alpine vegetation. In general, the entire mountain ranges of the Himalayas are more conveniently divided into two broad groups : (i) the Eastern Himalayas and (ii) the Western Himalayas. The former are far more evenly humid than the latter, being conducive to tree growth and consequently the timber-line or the upper limit of tree vegetation in the Eastern Himalayas is up to 4,570 m above mean sea level as compared to barely 3600 m in the Westren Himalayas. The two Himalayas ranges support very contrasting plant cover, associated with specific ecological systems. Indeed, the mountain ranges of the Himalayas mistch greatly in the environmental stipulations from that of the lowlands in the country owing to the physiographic edaphic, climatic, and biotic determinants. Pointedly, exclusive environment of the Himalayas is a veritable treasure-house of rare spectacular birds, butterflies, herbs, flowers, orchids, rhododendrons, magnolias, and other diversified tree forms.

Ecologically, the Himalayan environment is tree producing. The present tenor of Himalayan mountains is a consequence

of biotic entails acting upon it. As a matter of fact, the environmental conjuncture in the Himalayas takes its rise since man instituted particularly the practicing the natural resources of the Himalayas. Since times immemorial, the Himalayan mountains are conceived as awe-inspiring orb of manifestations of mighty freaks. Foremost rural settlements propagated around holy shrines on mountains which grew in size and people took to mountain agriculture, grazing of animals, mineral exploitation, etc. to various degrees. Ancient literature suggests that soil erosion, floods, land-slides, and other natural hazards were also established phenomenona in the mountains but were rastricted to small areas. It has been assessed that throughout the British semester, a number of summer hill resorts were perceived in various mountain ranges operated for viceroys, governors, and their officials who alighted regularly the hill stations in summer. This led to considerable socio-economic changes in the mountain populations. Simultaneously, the Britishes initiated clearing away of the forest wealth for plantations of coffee, tea, etc. which altered the composition of soil, vegetation, fauna, and other ecological parameters and has brought unfavourable stress on human and bovine populations. The plantations led to evolvement of highways, railways and graduel importation of modren technological advances. After independency what man has done to Himalayas during the past 34 years is a dolorous tale of unprecedented and massive deforestation, erroneous afforestation, dustruction of natural habits, illicit hunting of wild animals for meat, fur, wool, musk and other valuable products, abandoning of all traditional methods and practices of mountain agriculture, extenstion of cultivation of new areas, introduction of new crops, adoptation of new cultivation techniques, use of artificial fertilizers, application of pesticides, construction of large scale hydro-electric instalations, tunnels, drains, impounding of massive volumes of water by gigantic dams, construction of high mountain roads, etc. without considering the nature's view on these alterations. These human activities have caused drastic erosion, landslides, land slips, avalanches, silting, changes in river courses, lowering of soil fertility pollution and ultimately loss in primary (organic production made by green plants and secondary (organic production through animals) production and other natural resourses in the Himalayas which essentially are the principle problems facing the nation today.

Although an over-simplification, it is convenient to think of the Himalayas as composed of two houses namely 'nature's house' or 'natural environment' and 'mans

house' or 'developed environment'. The former presents that part of our environment which is essentially self-supporting, and a minimum of human management is required for its maintenance. This includes natural formations like forests, grasslands, rivers, etc. which produce useful adjuncts and recycle wastes on a continuous basis but without appreciable economic costs to man. These self-maintaining natural features run on solar energy including the energy of rain, wind and water flow that are deprived from sun power. On the other hand, the developed environment includes all man-made features that are fashioned and maintained by power flows from fossil or other concentrated fuels that supplement the natural energy flow of the sun. This includes urban, suburban and rural developments, agricultural fields, channelized rivers, etc., since they require a diversion of energy from man controlled power flows to maintain them in the developed state even through natural elements. The developed environment generates economic wealth but the economic cost of maintenance increases as a power function of the intensity of development. The true value of man's total environment is determined by the diversity interactions between the 'natural' and 'developed' features and not only by the worth of each as a separate component. However, the success of any house, natural or man-made, depends not only on the quantity and quality of its energy source but also on how efficiently the source is converted into useful work capable of maintaining the house as a whole. The food we ate and the fuel we burnt today is gone forever and must be replaced by new food and new fuel tomorrow. It is important to remember that the flow of energy is always a one way channel. Thus the energy can be stored but it cannot be recycled as other materials. The common notion of 'save for a rainy day' becomes appropriate when saturation levels of use approached, since energy and resources are always subject to periodic fluctuations and as the growth and activities in the man's house advance, pressure is exerted in nature's house. At this destination, proper management is required in order to maintain equilibrium. Considering the fact that the magnitude of man's house is aggrandising with whip and spur in the Himalayan mountain, eventually crumbling and waning the nature's house, serious thought and action has become successary. For instance, a perusal of the census reports would indicated that the human population in Kumaon and Garhwal deliberately ascended approximately 125% during seven decades between 1901 and 1971.

Perhaps up to 1950s, the natives of the region were self-supporting and obtained nearly all their essential requirements from within the region. The current size of population has, however, altered the situation. Today, the natives are dependent on lowlands for essential commodities and supplies or else retrogressive and illegal effects on natural resources are frequent and emerging in the form of altered land use patterns. It is really miraculous that in 1911, of the total area of Kumaon and Garhwal, 86% was under forest cover, 5% under cultivation, 4% as wasteland (uncultivated) and only 5% land was not available for cultivation. In 1971 the same parameters assessed were 38, 14, 12 and 36% respectively, for forests, cultivated land, uncultivated land and land not available for cultivation. The drastic reduction of 67% in the forest cover and expansion of 88, 326 and 816% land for cultivation, wastelands and land not available for cultivation, respectively is reached initially due to increasing demand of wood for domesticand industrial purposes, forestry mis-management, construction of roads, etc Simultaneously, when deforestation took place, introduction of modern techniques for crop rotation and production, extension of cultivated and pasture .lands which are not managed properly, progress in urbanization and other impacts of man on the landscape for immediate benefit also followed. The denudation of forests and their undergrowth has not only made the resources of fodder, fuel and industrial raw material obsolete, but have set in motion processes leading to erosion, land slides, loss of springs on the hills, and floods in the plains. A glimpse of our forest policy reveals that the guise for action is approximately indentical to that of the British Rules. The constant emphasis is to earn maximum revenue from the forests and although the forest cover is crumbling steadily, the margin of profit from forest resources is intensifying. In the Sixth Five-Year Plan, though emphasis has been given to regeneration of the forest cover, however, its principal objective is to promote forest-based industries without considering the interests of local populace in accordance with their environment. Inversely, in the past 32 years, 872,00,000 acres of deforested land has been afforested in China which is the most populous country of the world. It is essentially due to a public-oriented forest policy. Thus, all the scientific and technological management practices acquired presently by man are exclusively directed towards maximum quantitative gain by all means to earn more revenue and to compromise various local and political interests without considering its impact on natural environment or 'nature's house'. As such the modern developmental activities in the Himalayan mountains that is the planning to extend the man's house have proved to be extremely destructive to the nature's house. As such the natives are

swimming with the tide for acquiring the natural resources. In the same breath, the quantitative and qualitative reduction of the natural resources gradually stimulating natural calamities, which are again being faced by the inhabitants.

Ecological Planning and Management

Ecology emphasizes the study of the world as a house in which we live and from such a standpoint this house is known as the *Biosphere* or *Ecosphere*. Indeed the biosphere must be studied as a whole. This is obviously an uphill task and necessitates that the problems of the house are solved by studying units of biosphere of more convenient size known as *Ecosystems*, Thus the cities, towns, forests, grasslands, rivers, ponds. etc. can be exemplified as distinct ecosystems. It, therefore, becomes necessary for all of us-the laymen, as also the scientists, literate, social workers, and politicians alike to understand the reasons for man's increasing concern towards the environment around him. It requires a drastic attitude and revolution to perceive ecology and its basic principles if we are to proceed in an orderly and logical manner towards the solution. We are abysmally ignorant of the ecosystems of which we are dependent partners. As a result today, the scientist has become so specialized that he is unable to contribute to the current public dissatisfaction and longer scale problems that demand immediate attention. It is well-known that intensive researches at the cell level have established a firm basis for future cure and prevention of cancer at the individual organism or population level but the cell-level science will contribute least towards the well being or survival of human civilization if our understanding of the supraindividual level of organization is so inadequate that we can find no solution to population overgrowth, social disorder, pollution and other forms of societal and environmental cancer. Considering the facts it is unfortunate that till date the science which deals with supraindividual levels of organizations (ecology) is a pertial academic subject and has more limited scope (which has been suppressed by us) that the name indicated. As human-beings we do not go to rack and ruin to apologize for the reality that we are taking an active part in altering, controlling, and enjoying our natural environment to our collective advantages. It must be pointed out clearly that as the saturation level is approached and space and resources all are used than the explosive, wasteful approach becomes increasing unadaptive and must be shifted towards the peaceful coexistence of man and nature, law and order, family planning, complete waste disposal treatment, recycling and re-use of resources, the

regulation of land use, etc. It clearly reaffirms that we feel to want of a new tactics adaptive for today, i.e., use of our great power and wealth must be in order to maintain the quality of biospheric unit or the ecosystem. This approach needs to change Man's attitude towards his environment in the Himalayan mountains.

Today a number of specialists such as land planners, foresters, horticulturists, geologists, botanists, zoologists, economists social and political workers and organizations like HADA, BDO, soil conservation agriculture, animal husbandry etc. are acting differently upon Himalayan land scape with an identical aim i.e., development of the area. Regrettably not only do these specialists or organizations rarely communicate their findings with one another, but each also tends to restirict evaluations to its own preconceived narrow world of the natural or man-made environment, respectively, ignoring the fact that it is the interaction between these systems that is of paramount importance. Perhaps the most immediate difficulty in emerging the ideas of various organizations and specialists with ecologists is short-term and long-term benefit cost relationship, since in the real world monetary values are always going to weigh heavily in any decision regarding man's use of his environment. In fact it is the flow of energy and material from the environment that sustains the economy. Hence the actions which benefit the general environment also benefit the general economy in the long term. The land valuable for crop production, recreation and other life support would be preserved or restored. Indeed, the industrialized agriculture and short term gain systems in the Himalayan mountains are parasitic on natural systems which provide basic life support and the bulk of waste treatment work necessary for the operation and survival of these man-made systems. Since ecological studies are best carried out by teams of investigators who are united to their objective of seeking to discover the emergent proper ties of the whole but have different skills and secondary interests. Thus, it is imperative to establish Research Centres at district levels to promote such team-work where all aforementioned specialists, organizations and ecologists must work together for the real development of the region. This type of research centre is pre-requisite because :

1. Today various workers/organizations are enjoying the Himalayan land-scape complex by one way or another to promote developmental activities as promoting economic growth at whatever cost, yet are not correlated in their line of action.

2. It is important to note that each activity of man (including impact of landscape) requires energy which is trapped by nature's house and thus natural systems are more important than manmade ones.

If the rate of energy consumption is continued without considering any equilibrium with the nature's house, a stress would be developed for the survival of our future generations.

3. At the moment, all the above mentioned workers/organizations are working independently to cash their individual interests from the landscape and without considering environmental tragedy. As a result the Himalayan ecosystem is proceeding rapidly towards catastrope. Thus it becomes urgent to associate all these groups into "one" for sake of environmental conservation which is associated with the fate of our future generations.

In conclusion, it must be emphasized that the principles of ecology must be applied uniformally without any major interference of other disciplines on the Himalayan landscape complex.

Role of Social Forestry in Environment Conservation

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Environment is a sum total of the different factors i.e. soil, air, climate, biota and their interaction. The present day environment is a result of the different natural phenomena over millions of years. The existing life forms are a result of natural selection and are in perfect agreement with the prevailing environmental conditions. The changes in the environment in the past have been many but were mostly gradual but recently with the development of science and advancement of civilization and technology very rapid, sudden and undesireable changes have occured in the environment. The main factors responsible for the deterioration of environment are : human population explosion, increased agrarian activity, industrialization, mining, dam construction in the lower hills, urbanisation, modernised living, noise, nuclear activity and the worst of all thoughtless deforestation. According to a recent survey the tropical rain forests which are a part of the most delicate and intricate ecosystem on this earth are being cut at an alarming rate of 2½ ha per minute. Besides this deforestation is going on all over the world without an equivalent amount of restocking with the result more and more area is becoming degraded and is ultimately turning into waste land.

Deforestation along with the other above mentioned factors has resulted in a rapid deterioration of the environment. This deterioration is being manifested in the form of desert expansion, soil erosion, floods, pollution of water and air, increasing waste land, fertilizer, insecticide and fungicide pollution, wild life extinction, pollution of streams and oceans, acid rain etc. Man at present through his various activities in the field of science and technology is the biggest threat to environment and his own habitat. It is really an astonishing revelation that the environment which nature took millions of years to to build up may be devastated by man in another 50 years or so. The pollution and environmental deterioration has already reached formidable dimensions in some of the advanced and developed countries.

Acid rain drops in some countries were reported to be more sour than lemon juice even.

This increasing environmental deterioration has made every body to feel concerned. All concerned with the conservation of environment have come to realise the role of plants and especially of trees in the betterment of environment.

CONTRIBUTION OF TREES TOWARDS ECOSYSTEM

The role played by the trees in alleviating pollution of different types can be summarized as follows :

In the country side the trees conserve soil and moisture and are the cheapest large scale parasol shielding us from sun, rain and wind. They control the desert and reduce the wind velocity and are useful wind breaks and shelter belts. They are the best biological pumps for improving water logged sites. They increase precipitation, recycle the nutrients and increase the organic matter on the site, make the soil more porous thus increasing percolation and reducing the run-off water. They conserve water and regulate water supply in the natural source if planted in the catchment areas. In the form of forests they protect and harbour wild life.

The role of the trees in improving the polluted ecosystems of our towns and cities is equally vital and they are absolutely necessary in the form of urban social forestry as becomes clear from the following points which elucidate the effects trees in the urban areas.

1. Reduction of particulate pollution—As a result of wind reduction effected by the plantings, impurities in the air settle because the air's carrying capacity is largely reduced. Open plantings are more effective than dense ones. They act by of active filtration, passive diversion of air flow and protection of sedimented pollutants against pick up by wind.

2 Reduction of gaseous pollution—Here the things are not quite as clear. It has been suggested that gases in sub lethal concentrations (So_2, Co and N_2o) may be neutralised through the plant metabolism. Loss of atmospheric So_2 has also been reported near foliage.

3. Shelter belts—The filter effect might be used for the layout and planning of plantation screens. Screen barriers should be laid out at regular intervals, preferably at a distance of about 20-25 times their height. Shelter belts also prevent erosion by wind and water. In areas with plenty of

snow, shelter, belts may direct the snow drifts.

4. Protection against radioactivity—Large stands of trees and forests may reduce radioactivity in the air. With particulate radioactivity in the air, the foliage of investigated trees showed upto four times as much total radioactivity on the luff side as on the lee side.

With a content of 1 micro currie/cm^3 volatile radioiodine in the air (131I) it was found that 1 kg of foliage took up as much as 1 currie radio-iodine in one hour at medium air flow. (1 currie radio-iodine corresponds approximately to the radio activity of 1g of radium). Two-thirds of the radio-iodine was attached to leaf surface and could partially be washed off.

5. Reduction of temperature—In a study in Germany temperature differences of upto 3.5° C were observed between Frankfurt city and a 50-100 m wide 5 km long vegetation ring surrounding the city. Assuming an air temperature drop of 1° C with every 200 m of increasing altitute, the 3 5° C decrease corresponds with an elevation of 700 m.

This cooling effect is not only due to the dimenution of radiation by the leaf canopy of the trees but also to the reversal of the facts of the causes of heat islands.

The main point is evapotranspiration which uses an average of 60-75% of radiation energy

6. The rise of relative humidity in the air—The lowering of temperatures corresponds a rise in relative humidity, which is always too low in towns.

According to an estimate a street tree evaporates 5 m^3 of water yearly. 500 street tree/ha would evaporate 2500 m^3/ha water, resulting in a cooling effect of $1.5x10^9$ K cal/ha/year. When trees are lacking, that quantity of energy stays in the town.

7. Influence of trees and green spaces on urban ventilation—In a city without trees and green areas the wind will continuously pick up pollution particles, but trees and greenery in the direction of the air, absorb carbon dioxide and release oxygen.

8. Noise reduction by trees and shrubs--For noise control the tree leaves should be as big as possible, hardnextured and closely arranged. Most of the tempe-

rate broad Leaved species are good for noise control.

9. Oxygen release by trees in town and forests—According to an astimate a 100 year old beech tree 25 m tall, with a crown diameter of 15 m and a total leaf surface area of 1600 m^2 produce 1.7 kg oxygen/hour while consuming 2.35 kg of Co_2. This beech tree meets the annual oxygen requirment of 10 people. If it is felled, 2700 young trees, each having a crown valume of 1 m^3, would have to be planted to obtain the same result.

Now this is where social forestry comes into picture. As a matter of fact social forestry is not prectised for the purpose of environmental conservation, it comes as a bonus alongwith other products viz. fuel, folder and fruit.

Social forestry envisages reforestation and afforestation of all available sites with a purpose to make available to the local population their routine requirements of fuel, fodder, fruit, small timber for agricultural implements and house construction and to provide employment opportunities.

National commission on Agriculture—identified the following areas and components in social forestry programmes.

A. Farm forestry
B. Extension forestry
C. Reforestation of degraded forests
D. Recreation forestry

The following types of areas may be alloted for social forestry activities :

1. Private lands
2. Revenue waste lands
3. Degraded forests and other forest areas near habitation.
4. Rail road and canal side areas
5. Panchayat lands, village commons and other areas

Various systems for Agro-forestry too will contribute towards the environment conservation, because of better land use adopted in this practice.

Urban social Forestry— in the form of Avenue plantations, shelter belts, city forests, gardens and terrace gardens have a vital importance in conserving and improving the city environment. As a matter of fact the trees should be in integral part of the town planning and a definite amount of plantations should be prescribed depending upon the architectural plans of the city so that pollution resulting

from increasing urbanisation and industrialization is reduced to the minimum.

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The Biosphere

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The concept of biosphere was first of all proposed by an Austrian geologist, Edward Suess in 1875. However, the concept attracted little attention until 1926 when it was placed on a sound footing by Vladimir Ivanovitch Vernadsky, a Russian mineralologist, who traced the idea to French naturalist, Jean Baptiste Lamark. It is basically the Vernadsky's concept that is accepted today. The terminology in the biosphere concept has been quite flexible. According to Vernadsky the biosphere is the external envelope of the earth which is inhabited by living things. In other words, biosphere is that part of the earth in which life exists. It comprises of all the living organisms of our globe and the elements of inorganic nature providing the medium for their habitat (Kamshilov, 1976). Thus all the living organisms, products of their activities like deposits of lime and fuel, inorganic constituents required by organisms for their vital activities like water, oxygen, carbon dioxide, nitrogen, mineral elements etc., and habitats of organisms like burrow', nests, houses etc. are constituents of the biosphere.

Extent of the Biosphere

If biosphere is defind as the region potentially capable of supporting life, the upper limit of biosphere would reach the ozone screen enveloping the earth and the lower limit would extend to the ocean floor and deep lying deposits of biological origin on the land. However many times the definition is restricted to the region in which metabolically active organism are found. In this sense biosphere is irregular in shape and is surrounded by an indefinite parabiospheric region where some dormant forms of life like spores, pollen grains, seeds eggs etc. are present. Thus in the strict sense the upper layers of the atmosphere where only the spores of bacteria, fungi and pollen grains are found, and extremely hot and cold regions of the earth's surface not capable of supporting metabolically active organisms, are parabiospheric.

The vertical limit of green plants on land is about 6,200 m. Region above this is characterized by lack of liquid water and low carbon dioxide content. At an altitude of about 6,500 m a few animals like spring-tails and mites may be sustained on pollen

grains and spores, and the spiders feeding on these animals. In the upper few meters of ocean water, the euphotic zone where light can penetrate, supports photosynthetic plants. However, animals can survive in light poor zone, the dysphotic zone, and even at the dark ocean floor deriving their energy from organisms, dead and alive, and their fecal pellets, castings etc., falling from above.

Conditions for the Existence of Biosphere

There are the apparent conditions for the existence of biosphere :

i Presence of liquid water in substantial quantities.

ii Ample supply of energy from an external source.

iii Interfaces between the liquid, solid and the gaseous states of matter.

Water is an important constituent of life, e.g., it constitutes about 60% body weight in human adult, about 73% in mouse and about 80% in bacteria. Since water is absorbed by organisms in liquid form, existence of biosphere needs substantial amounts of liquid water.

Energy is required for vital functions of organisms. The ultimate source of energy is sunlight which is converted into chemical energy by plants, which in turn provide food to herbivores and so on in the food chain. Thus biosphere exists on solar energy.

It is well established that it is much easier to live at interfaces of solid, liquid and gaseous states of matter rather than in a single state, for example, anorganism can better grow or live at water-air interface as compared to only water or only air. Similar is the case with soil-water and soil-water-air interfaces. In fact the plants which grow at soil-water-air interfaces e.g. the marshy plants have higher rate of photosynthesis.

Components of Biosphere

Biosphere is a complex of many components. These can be put under four categories-atmosphere. lithosphere, hydrosphere and living cover :

1. Atmosphere—The atmosphere is a thick gaseous envelope that surrounds the earth and permeates its crust and oceans. The compositional layering of atmosphere reveals that it is quite uniform upto first 80 km. The lighter gases are present at higher altitudes. The composition of dry atmosphere by volume is given below :

Composition of dry atmosphere

(Donn, 1972)

Component	Volume (%)
Nitrogen	78.08
Oxygen	20.95
Argon	0.93
Carbon dioxide	0.033
Trace Components	0 003

About 99% of the atmosphere is composed of only two gases, the nitrogen and the oxygen. The cummulative pressure makes the atmosphere denser towards and rarer away from the earth surface. As an interesting example, the atmospheric pressure is one half at a height of only about 5.5 km from the earth's surface. This means that half of the atmosphere lies below 5.5 km only The atmospheric pressure at a height of 100 km is so low that it is more or less a vacuum.

One of the most important properties of atmosphere is the presence of ozone layer at a height of about 32 to 48 km. This ozone layer is a screen to check ultraviolet radiations which could otherwise be lethal to living organisms. Interestingly ultraviolet radiations seem to have played an important role in the origin of life.

2. Lithosphere— The earth is coarsely layered into crustal shell, mantle, outer core and inner core–proceeding from surface towards the centre. It is the outermost layer of the crust which is a component of the biosphere and provides a medium for growth and shelter of the organisms. The mean thickness of the crust is about 32 km below continents and about 5 km below oceans. The chemical composition of the earth's crust reveals that about 98.59% of it is constituted by 8 elements as given below :

Chemical composition of the crust (after Donn, 1972)

Element	Weight %
Oxygen	46.6
Silicon	27.72
Aluminium	8.13
Iron	5.00
Calcium	3.63
Sodium	2.83
Potassium	2.59
Magnesium	2.09

The outer most weathered layer of the earth's crust in which organisms can grow is known as soil. Soil consists of dead organic matter in addition to inorganic constituents and thus harbours the microbial life.

3. Hydrosphere—Hydrosphere is the reservoir of water and constitutes an important component of biosphere. Oceans arose due to condensation of water vapour and account for 70% of earth's surface. In the beginning the oceans had fresh water but for billions of years rivers have been active in transportation of salts to the ocean with the result that at present every 100 kg of ocean water contains about 3 5 kg of salt. Chemical composition of the sea water is given below :

Chemical characteristics of ocean water (after Donn, 1972)

Component	Concentration ($g\ kg^{-1}$)
Chloride	18.97
Sodium	10.56
Sulphate	2.64
Magnesium	1.29
Calcium	0.41
Potassium	0.38
Bicarbonate	0.14
Bromide	0.07
Total	34.46

Calsium, bicarbonates, sulphates and silica brought by the rivers to the ocean get sedimented to the ocean floor in the form of insoluble compounds.

4. Living Cover—Living cover of the planet constitutes one of the most important components of biosphere as it links atmosphere, lithosphere and hydrosphere by its various biological activities. The animal kingdom (no. of species=million) appears to be more versatile than the plant kingdom (no. of species=265500). About 75% of the animal species are insects and about 56% of plant species are angiosperms. It may be observed that angiosperms are the most advanced group among plants and best adapted to various climatic conditions. Insects because of their dependence on angiosperms have coevolved during evolutionary process. An estimate of biomass (weight of living matter) of organisms on earth is given below :

Dry matter in 10^{12} tons of organisms (after Bazi levich et al., 1971)

Continents :	
Green Plants	2.4
Animals and microorganisms	0.02
Total	2.42
Ocean :	
Green Plants	0.0002
Animals and microorganisms	0 003
Total	0.0032
Grand Total	2.4232

It is interesting to know from the data that plants predominate the continents while animals predominate the oceans. The total dry weight of the organisms on land is quite large as compared to oceans although oceans cover about 3/4 of the earth's surface. High salinity and poor penetration of light in the ocean water limit the growth of organisms in ocean.

The exchange of various constituents like water vapour, oxygen, carbon dioxide, nitrogen, mineral constituents etc. in atmosphere, lithosphere and hydrosphere through living cover is known as biotic circulation and forms the basis of biosphere. The significance of biotic circulation can be seen from the fact that all the earth's water is split by plant cells every 2×10^6 years, oxygen generated by photosynthesis enters the atmosphere and is recycled every 2000 years and carbon dioxide produced by respiration is refixed by plants every 300 years.

It may be concluded that biosphere is not an inert sphere but a dynamic entity governed by laws of nature. Any interception by man in the processes occurring in nature may have devastating effects.

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Problems and Prospects of Aqua-Resource Managements in Himalayas

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The Himalayas occupy an area of 250-400 km. wide and 2500 long, at a regular stretch in the north-west, north & north eastern region of our country. The impact of mighty Himalayas on the geo-physiography, ethonology, history and cultural heritage is well known to all of us. Similarly this mountain chain has profound influence on the climatological and environmental front of this sub-continent. Infact we can safely say that almost the whole climate-round the year-is under direct control of the Himalayas, its forests and riverine systems, besides the snow capped mountains. As regard the role of Himalayan mountain system with reference to water resources-the position is very crucial. The Himalayas intercept the moisture ladden winds from Indian ocean, in the south, and participate to the monsoons in the north. The whole belt of Himalayas act as a great reservoir of water, to be made available round the year, in various forms. The whole of the northern India fully depends for its aquatic requirements on the Himalayan realm. Not only the atmospheric humidity is preserved, but the ground aquefers are also regularly replenished, by allowing the water either to be absorbed by the soil or to seep it deep down-only to be made available some where. During the winters the Himalayas, due to their specific cooling effects, trap the moisture of the air and clouds in snow ice form. The ice and glaciers of Himalayas act as a perpitual source of water-round the year-for the riverine systems of north India, Besides, the Himalayan valleys have provided few of the best sites-in the world-to develop hydro-electric and irrigation projects. This in very brief, clearly shows that the role of Himalayas is yet to be better observed studied and managed for healthier exploitation of its multi-dimentional aqua-resources.

Aqua-resources of Himalayas

The Himalayas preserve the water with them in various forms, only to be made

available to us through varied channels. The water sources are :-

1. The ice cover and the glaciers
2. Rivers
3. Lakes and reservoirs
4. Ground aquefers

1. The Ice cover and the glaciers— According to Wissman (1959) about 33200 sq. km. area of the Himalayas is under the thick sheet of ice. This constitutes about 18% of the total area of the Himalayas. And that this thickness of the ice layer varies between 10m to 400m. Thus apparantly this whole ice realm is a perpetual source of water for a large number of rivers, rivulets, springs and lakes with in the Himalayas or in the Himalayan foot hills. The another most important aspect is that it is the cooling effect of these iced mountains which cause monsoons to melt.

The glaciers, on the other hand are directly responsible for making available to us a number of rivers of the north India. It is indeed ironical that till now not much work has been done even on the number and distribution of glaciers of Himalayas. Where as the work on these lines is fully available in the neighbouring countries like Tibet, Pakistan and China. However still according to some conservative estimates there are about 15000 glaciers in the Himalayas (Vohra, 1978). The glaciers are important not only because these make a large amount of running water available to us but also because these play an important role in the generation of floods, avlanches, soil erosion and soil formation.

The glaciers are in turn affected by the altitude, distance of the mountains from the equator, slope angle, duration of solar radiation available to them and the direction in relation to sun movements. The glaciers are the important kinetic sources of melting water. The Gangotri glacier, for example, is estimated to be of 20 $km.^3$ in volume, wheareas the Bhakra dam is less than $8km.^3$ And that the glaciers are by and large, self responsible, where as the dams are not. The thickness of the ice sheets of the few glaciers in the Himalayas has been worked out., which is 300m, 120m. and 135m., respectively for the Zemu glacier in Sikkim, Gara glacier in Himachal Pradesh and Nehnar glacier in Kashmir. The average annual water discharge from Gara glacier for the period 1974-77 was 12x10 m^3 (Vohra, 1978).

Retreat of the Glaciers— Due to a gradual change in the global environmental concentration in Co_2 contents and a little rise in the ambient temperature etc. the

glaciers all over the world are receding conspicuously. In Switzerland where 100 glaciers are under watch for last many decades, 82% were found receding in 1963-64 and 40 % in 1974-75 (Kasser and Allen, 1976). Similarly in India the retreat of glaciers in Himalayas is rather rapid, as is clear from the data in table-1. This would cause far reaching influences on the water resource management in near future.

2. **Rivers**— The Himalayas are the lone source of all the major riverine systems of the north India, viz. the Indus, the Ganges and the Bramhputra system.

The Indus system arises in the Tibet region of the Himalayas and after traversing through the Kashmir and then Pakistan end in the Arabian sea. It has a total catchment area of about 4,68,000 sq. km. upto Indo-Pakistan boarder. This system embraces hundreds of rivulets and about a dozen major rivers of the region. The ecological implications of this river systems are felt up to Punjab and Haryana, in general. The Ganga emerging out of the Gangotri glacier in the central Himalayas of U.P. is the most important riverine system of the north India. The total catchment area of the Ganga system is over 5,11,000 sq. km., out of which about 3,00,000 sq. km. lies in India. The Bramhputra, like that of the Indus has its origin in the Tibet region. It has a total catchment area of nearly 5 80,000 sq. km., out of which 1,87,000 sq km. lies in India. Thus according to the data furnished by the Irrigation Commission of the Govt. of India, out of total usable surface water resources of 540 MAF (million acre feet) over 200 MAF is contributed by these three river systems in this country.

As is clear from the foregoing account that the three major river systems originate from the Himalayas, the importance of this mountain system becomes more significant vis a vis to water resource management, specially for the whole part of the northern India. All these rivers are fed by the snow, glaciers and rains in the Himalayan region. Thus the role of Himalayan forest system becomes inseparable in this contex.

3. **Lakes and reservoirs**— Although no correct figures could be available for the total number of small, medium and large sized lakes or reservoirs for the Himalayan region, even then at a conservative estimate there are about 12000 such water bodies scattered in the valleys of the Himalayas and its foothills. The lakes and reservoir play a prominent role at the local micro environment level in supplimenting the local needs and enriching the local atmospheric humidity. Some lakes and ponds

also contribute in accomodating large volumes of rain water, specially during the monsoon periods, and thus also minimise the fury of the floods in the region.

4. Ground aquefers— As a large area of the Himalayas is under perpetual snow and ice, besides that the region obtains maximum annual rainfall, hence the area must also contribute greatly to the ground aquefers and continuously replenish the same. This is apparent from the fact that the whole of the Himalayan realm is richly endowed with large numbers of springs, not lying in the area of any glacier or zone of ice melting. It is generally beleived that ground aquefers hold great potentials in fulfilling the growing needs of water, but are yet totally unexploited. This area offers, thus, a large scope of work and resource management for rich exploitation.

Hydro–electric and Irrigation-Project-Potentials in the Himalayas— The Himalayas, even with a very conservativ esimate have potency of giving us about 60,000 MW, of hydel power. Presently only about 2400 MW is being obtained, from a number of projects lying mainly in the foothills of the Himalayas. It is only during the past decade that when all the best foothill sites were exhausted to create irrigation and hydel projects, the Govt. has entered deepet in to the vergin mountain valleys. As a result projects with expected potentials of 1500 MW capacity are under way of development. Though the Govt. is doing a lot to exploit the hydro-electric potentials of the aquatic resources of the region the projects purely for irrigation purposes, where specially the extra rain water can be used, or none. Even few very important and prestigeous projects like Tehri dam project and Vishnu Prayag Hydel projects are being constructed very slowly. The Tehri project which was to be completed by this year would only be completed by the end of 1991-92, and that too with an extra cost of about Rs. 630 crores. Still there are great potentials and areas available in the hill valleys where small to medium sized aquareserves could be created, specially for conserving the monsoon waters. If all these areas are turn in to use it is hoped that an extra area of 10000 mill. ha. could be brought under irrigation in the hills and the Indo-gangetic basins.

It is reported that presently Govt. is seriously contemplating about the setting of nearly 200 small to large sized such hydro-electric and irrigation projects, but the poleticized hue and cry and lack of funds is delaying these.

Problems Related to the Water

Management in the Himalayas—

Himalayas have two distinct zones, one the ice capped mountains and second the forests. Paradoxically it is generally believed that the forests are the source of floral wealth only, and the former are of water. But in fact it is not so. The forests play vital and very crucial role in the conservation, regulation and management and water cycle, that too again not only for the Himalayan region but for the whole of the north India. Thus the forest management and water management in the mountain realms are not only intimately but inseparably related to each other.

Thus the problem of water conservation actually also becomes a problem of forest conservation. In our country two vital concepts are growing in two opposite directions. First is the rapid industrialization and second is slow consciousnes and planning of environmental protection. The former by and large thrives at the cost of the later. Therefore the major problems related to conservation. All other problems are the side problems related to the same. Such as evapo-transpiration, rapid runoff of the water, poor absorption, poor resistance by the thinning forest canopy, soil erosion, sudden cloud brust, increasing human settlements, receding glaciers, increasing deforestation, siltation of river and lake beds, erratic rain fall pattern, increased fuel and fedder demands and the human consumption of the potable water, are few of the many hazardous problems. Out of these soil erosion, floods, potable water and deforestaiion are of special mention.

Soil erosion : The rainy season is gradually proving a killer of the mountain eco-system in general. Due to deforestation the heavy rains erode and corrode the top soil of the hills and sweep away the rich organic litter and humus. Thus the water is highly turned turbid to muddy and this leads to heavy siltation of the water reservoirs and rivers. It is important to note that the making of the top soil is more time taking than that of a lush green forest. It is well said that a forest can be created with in a span of 100 yrs. only, where as the top soil which sustain the flora and the dependent fauna takes a maximum of 1200 years in making at the top 10 cm. of the profile. It has been estimated that rains and floods wash away top soil worth Rs.400 crores, annually from the Himalayan belt only. Secondly the part of the soil which has been carried away by the rains, so mercilessly, is by and large dumped to the oceanic depths-where it is of no use.

Floods—Himalayas and its whole chain of mountains has a unique role to play in the genesis of the floods. The floods are now of annual recurrence, any where in the country and more so in the north of India.

According to Murthy (1978) only the four states of north viz. Assam, Bihar, U. P. and West Bengal suffer to the cost of Rs. 1,332 millions, annually. Now it is the extra water which has been allowed to flow unchecked and unmanaged from the mountains, mainly. Himalayan region all through its geographical area gets the highest rain fall round the year. And since the forest have thinned to put any barrier in the flow and gradual absorption and seepage, the water accelerated by gravity and its own volume is delivered in the form of floods to the Indo-gangetic basin. Perhaps there is some truth in the comment of an ordinary hillman when he sarcastically said that "well if the people down in the plains suffer, it is good; because they deserve it. As who else is responsible for cuttin down our forest and causing these floods." The point is-our policy specially, oriented to forest conservation and water managements needs a second thought.

Siltation of surface aquefers — The amount of water to be transported by any river has a direct bearing with its depth, span and slope. Just twenty years ago the rivers were deep enough, wide enough and rapid enough to carry high amount of water without any spillage. But now these are heavily silted, turned shallower, water velocity slowed and the dams too, shallowed in their water bearing capacity. According to the Public Accounts Committee of Govt. of India's latest report of 1983 the country is loosing over Rs. 400 crore every year, because of heavy siltation of major reservoirs, all over the country. It is because the catchment areas in the rivers of north are now too denuded to check the soil erosion. As a result of this, there is a great loss in the water bearing live capacity of the river as well as reservoirs, and water has no alternative other than to spill away and spread in the form of flood. Values given in table-2 show that there is a great decline in the life span of the few major dams of India, due to siltation, only.

Some Preventive Suggestions :

Regarding the Water Management in the Himalayan Realm About few decades ago there was no imminent problem of water management in the mountains. It was mainly because population was low, forests intact, soil erosion least and river flow normal. But now the situation is just the reverse. Therefore, author is inclined to opine the following few of the suggestions-which would be of immense help with regard to the problem of water conservation and management in Himalayas.

1. Afforestation of the Mountain slopes and catchment areas : – This

is the most important aspeot of forest ecology. And offers a part of the solution at the basic or the proverbial grass root level. It has been estimated that if the whole area, of concern, is to be put under this programme then it may cost around Rs. 15000 crore, at a time. But studies have also revealed that all the areas in the mountain realm do not need plantation. The catchment pockets of the flood causing rivers have already been identified-to greater extent. This reduces much of financial and planning burden. As regard the resource person, it is suggested that we have great forces, unused, in the form of unemployed youths, College and University going students and the retired armed personnels. These bodies must be put to task of environmental protection, preservation and enrichment, by way of arranging camps in the right seasons of the year. They are not be paid, but their all boarding, lodging and travel expenses be bourne by the state and the central Govts. For example cadets of N.S.S. are doing a great service of the nation-by participating in these programmes. Trees allow more water to seep into the soil, beside acting as barrier in the torrential flow of the rivers at all levels. They keep the ambient atmosphere humid, thereby reducing the rate of soil water evaporation besides the tree stems, leaves, litter and underground humis-these all tend to retain water as much is possible. Soil erosion is checked, and reduced, consequently siltation would be checked, this would ultimately increase the life span of the reserviors.

2. Development of mini hydro and hydel projects— The time has already ripened to cause concern for us all that, we and specially the policy makers of this country must now abandon the planning and construction of the giant dams and reservoirs. We have already paid too much for that and due to these. Now we must immediately switch over to construct mini water reservoirs spread and scattered all through the length and width of the Himalayas. Construction of mini dams provide a number of financial and environmental conveniences such as :—

i. The mini dams and reservoirs could be completed in the stipulated time.

ii. They cost less.

iii. These do not ereate considerable pressure on the geo-strata, so as to cause geo-tectonic problems, as has been associated with giant dams, like Koyana.

iv. The resources are well distributed in varied geo-physio graphical realms.

v. Maintenance of small reservoirs is convenient, and in times of any calamity their management within easy reach.

vi. The mini reservoirs construction in a series through-out the length of a river-improve the efficiency of the succesive reservoirs. This is acheived because, the reservoirs at the upper zones will collect much of the silt, soil and the bebrish. This would naturally inhance the life and functioning of the dams or reservoirs down stream. The live capacity of the dams etc. can also be well maintained.

vii. Irrigations facilities are well distributed in various regions and management of hydel or the irrigation projects is facilitated.

viii. The small dams so distributed would also be of great help in flood control.

ix. Since small dams etc. would require lesser ambient area for their capacity hence the wild life flora and fauna would not be much disturbed.

x. Job oppurtunities would be distributed to various regions.

xi. Development of fisheries goes well with the smaller dams, rather than with the larger ones.

xii. Smaller dams and associated projects can be developed at a comparatively small place of convenient approach.

xiii. Smaller projects can be choosen according to the regional environmental needs as well. If there is any forest or land area which is prone to soil erosion or to land slide then such small projects will prove a boon to that area and will also be of great help in the water management at the down stream.

3. Silt check gullies— It is suggested that for the proper maintenance of live capacity of a reservior and the bearing capacity of river, at the bottom of the related catchment area silt check gullies could be constructed. Because there are not many erosion prone areas hence this would not cost much to the Govt.

4. Closure of the dry valleys— In the catchment areas of a number of rivulets or rivers there are no perenial streams as a result the monsoon water flows through the seasonal and temporary gullies. It is suggested that since such valleys are already closed from three sides and offer a sufficiently spacious inter valley space-this can be closed at the open end with minimum cost envolved. This would store the rain water temporaily, and at least would check the genesis of the floods. Many such dry valley closures would certainly increase the aqua resources of the region.

5. **Check on the deforestation**— The areas which fall in the direct catchment areas of the major river systems all over the Himalayas must be abandoned from all sorts of tree cutting or tree exploitation activities viz. resin taping etc.

6. In the course of already existing large sized dams, to increase their efficiency and the life span-mini check reservoirs can be constructed, even now, at a very economic cost.

7. At the foot hills, to collect the extra water during the rains loop canals can be constructed-with distributing channels on their sides, in their turn,

8. More hydel projects of medium and micro size be developed in the Himalayan valleys and at the foothills.

9. The project which are in hand must be completed at earliest. So that the construction cost does not escalate and the project starts benifitting to the common consumer for potable water or for irrigation needs or for electricity.

10. To save the forests from being exploited for the fuel purpose in the Himalayan region, the higher production of hydro-electricity and its cheap distribution be done at earliest.

11. *In the hills* horticultural activities and orchard development should be encouraged as against the plough-cropping agricultural activities. This would require lesser tilling and digging and lesser water for irrigation on one hand and the orchard plantation would provide a better conopy to the under soil.

12. **Development of tourist bungalows,** rest houses etc. should not be allowed in the deeper parts of the forests. As one such activity warrants to another related activity like construction of a pucca road. This in turn often leads to the blind deforestation and dynamiting-leading to the loosening of the soil or the mountain strata and consquently to landslides or to continued soil erosion.

13. Afforestation should include the water conserving species, broad leaved species and local or the endemic species and plantation of the exotic species like that of the Eucalyptus etc. should be abandoned.

Table-1. Data showing the retreat of few important glaciers of the Himalayas.

Glacier	Duration	Retreat in meters
1. Zemu	1909-1965	440
2. Milam	1849-1966	1350

3. Pindari 1845-1966	2840	
4. Gangotri 1935–1976	600	

Table-2. Comparative life span of few important reservoirs

Reservoir	Original life span (Years)	Now expected life span
1. Tungbhadra	311	245
2. Matatila	357	108
3. Mayurakshi	872	198
4. Hirakund	110	35
5. Bhakra	98	47
6. Gandhisagar	930	348

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On the Conservation of Medicinal Plants in Sikkim

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It would not be incrediable that Sikkim represents its own ethnical and cultural heritage which impressed people since time immemorial. It is mountainous state bounded by Tibet in the North, Bhutan in the East, Nepal in the West and Bengal in the South. The elevation ranges from 700 to 28,000 feet above mean sea level. Most of the population is settled below 7000 feet elevation, though on higher altitude also vegetation found. The geographical area of the Sikkim is 7,325 sq. km. An area of 262.14 thousand hectare is under forest, 102.42 thousand hectare under pesture, 81.23 thousand hectare are cultivate land, 4.0 thousand hectare under various fruit crops and 274.19 thousand hectare are either barren or uncultivate or unaccounted land.

Sikkim is explored by various eminent batanists in the past. G. H. Cave, G. A. Cammie, C. B. Clarke, D. Plain, R. Pantling, W. W. Smith etc. are among those personnel who have made authentic study of vegetation after Sir Joseph Dalton Hooker's (1640-48) expedition to witness floral wealth of earstwhile Sikkim kingdom ranging from lower tropical forests to the temperate, alpine and higher alpine forest belt.

Sikkim's floristic includes more than 375 plant species of medicinal importance. *Aconitum, Acorus, Ephedra, Gynocordia, Lycopodium, Nardostachys, Picrarhiza, Piper, Pcdophyllum, Rheum, Swertia* etc. are the important genus having medicinal and commercial utility.

During plant survey with a view to acess the medicinal plant wealth of Sikkim, the author observed that a number of medicinal plant species which are raported for a fair abundence and distribution, are becoming scare or extinct. Due to the biological interference, rapid urbanization such as construction of roads, building etc., land unheaveals, protracted period of rains and glaciation, deforestation etc. have resulted indiscriminate destruction of luxurient vegetation. In addition to these

root causes of extinction, a large amount of damage caused to important medicinal plant species by commercial exploitation to extract drug as seed, fruits, flowers, bulbs, tubers, roote, rhizomes and entire plants.

At this peak time, when sole objective is conservation of national biological wealth, following threatened medicinal plant species growing wild in Sikkim are being given hereunder to devise out method for their conservation and working out alternative strategies for their exploitation without further depletion.

1. *Acorus Calamus* L.
(Fam. Araceae)
2. *Asclepias curassavica* L.
(Fam. Asclepiadaceae)
3. *Berberis nepalensis* Spr.
(Fam. Berberidaceae)
4. *Daphne bholua* Ham. ex Don.
(Fam. Thymelacaceae)
5. *Dioscorea deltoidea* Wall.
(Fam. Dioscoreaceae)
6. *Drosera peltata* Sm.
(Fam. Droseraceae)
7. *Fraxinus floribunda* Wall.
(Fam. Oleaceae)
8. *Gentiana Kurroa* Royle
(Fam. Gentianaceae)
9. *Lycopodium cernuum* L.
(Fam. Lycopodisceae)
10. *L. phiegmaria* L.
11. *L. selago* L.
12. *Nardostachys jatamansi* DC
(Fam. Valerianaceae)
13. *Pithecellobium bigeminum* Benth
(Fam. Mimosaceae)
14. *Podophyllum hexandrum* Royle
(Fam. Podyphyllaceae)
15. *Rauvolfia serpentina* Benth ex Kurz
(Fam. Apocynaceae)
16. *Rheum emodi* Wall
(Fam. Polygonaceae)
17. *R. nobile* Hook f. & Thoms.
18. *Saussurea lappa* C. B. Cl.
(Fam. Asteraceae)
19. *Skimmia laureola* S & Z
(Fam. Rutaceae)
20. *Solanum Khasianum* C. B. Cl.
(Fam Solaneceae)
21. *Valeriana hardwickii* Wall
(Fam. Valerianaceae)

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BOOK REVIEW

KAUSHIK, PURSHOTAM, 1983. Ecological and Anatomical Marvels of the Himalayan Orchies. Today and Tomorrow's, New Delhi, India. 29cm x 22cm PP. viii * 124 and 71 plates. Price Rs. 325.00 $ 65.00 (Hard cover).

This research monograph is the VIII volume in the series Progress in Ecology by eminent scientists in various fields. Today and Tomorrow's this time have brought out a publication which highlights the interesting original findings on ecological and anatomical aspects of Himalayan Orchids. These aspects of the orchids remained neglected all over the world in general and India in particular where little work has been done in this direction. This fascinating publication has appeared in propitious time and will serve the persistant demand of those interested in the Himalayan resources, especially of the wild life experts and orchids lovers. The author who personally surveyed the flora of the Himalayan provided here an invaluable information and has put the maximum in a nutshell.

Orchids are the most valuable horticultural plants and make excellent indicators of environmental quality. Taxonomically orchids stand at an evolutionary level higher than any other taxon. In the present monograph, the author has dealt in detail, ecological and anatomical account of morphologically unique and beautiful, lithophytic and epiphytic orchids belonging to tribes Cypripedioideae, Orchideae, Neottiae and Epidendreae (including vandoid group). Anatomy in relation to ecological adaptability has been discussed. A good many interesting anatomical features so far not known in the anatomical literature have been worked out which unravel the mystery of their ecological adaptability under various climatic condition and ecological habitats. The mycorrhizal association is also given. The anatomical features which can be used as taxonomic characters are pointed out. A phylogenetic classIfication of Orchidaceae based on morpho-anatomical characters has been devised. The author has proposed two new genera *Hydroplecellulosa* and *Mehrania* (in honour of Prof. P. N. Mehra).

Orchids in ancient Indian literature, medicinal value of the orchids along with their alkaloidal contents and the endangered orchids have been discussed. The formulations of Astavarg Churn and Chyawan Prash are also included.

The author has followed the latest nomenclature. The orchid genera and species included in the text along with major terms have been indexed.

The author is an orchidologist of good standing who professed research and teaching at Panjab University, Chandigarh, Guru Nanak Dev University, Amritsar and Gurukul Kangri University, Hardwar.

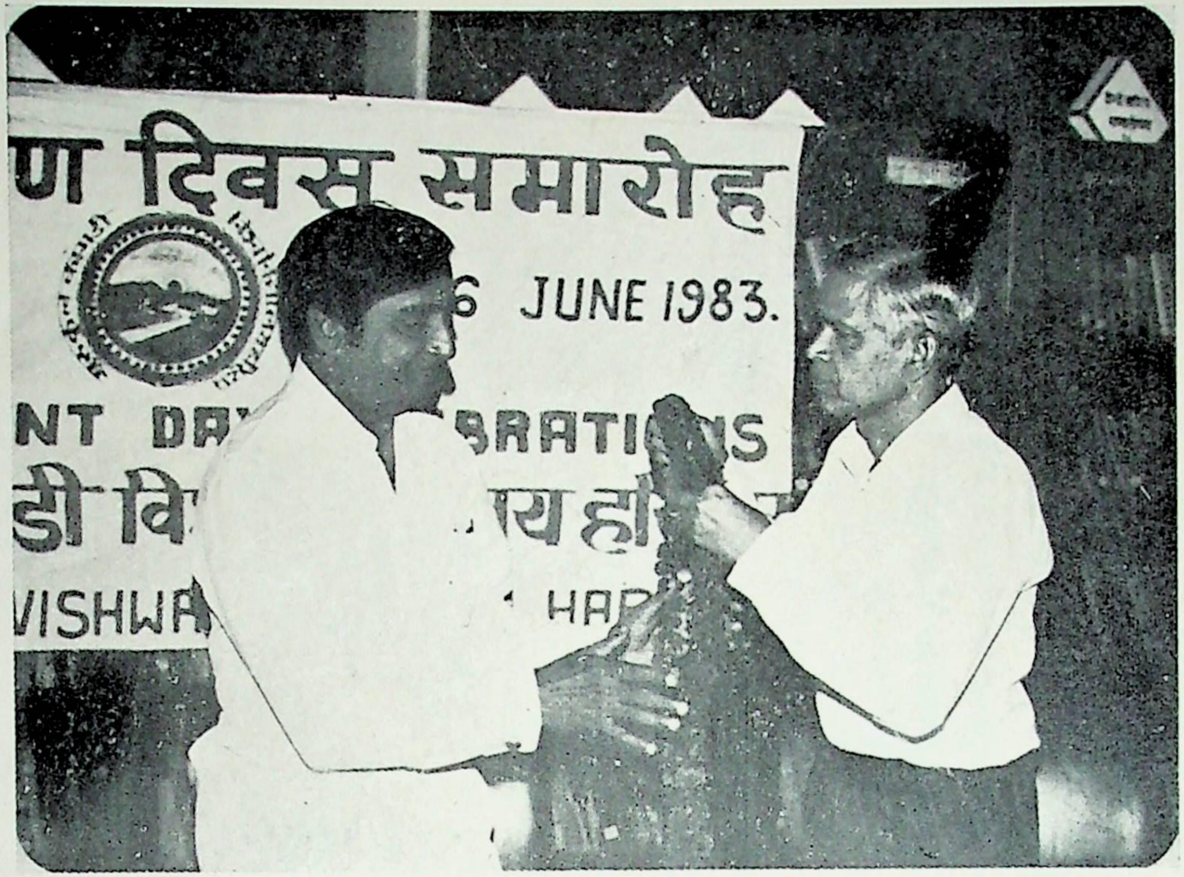
At a juncture when we are heading for an environmental crisis, a treatise on this particular group of plants, the very existence of which is threatened due to environmental deterioration, is an endeavour towards better understanding of the orchid world and will form an important reading for ecologists and taxonomists alike. The author and the publishers deserve all praise for this rare distinction and the scientific world can expect more from them on the subject in future as well.

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Guru Nanak Dev University,
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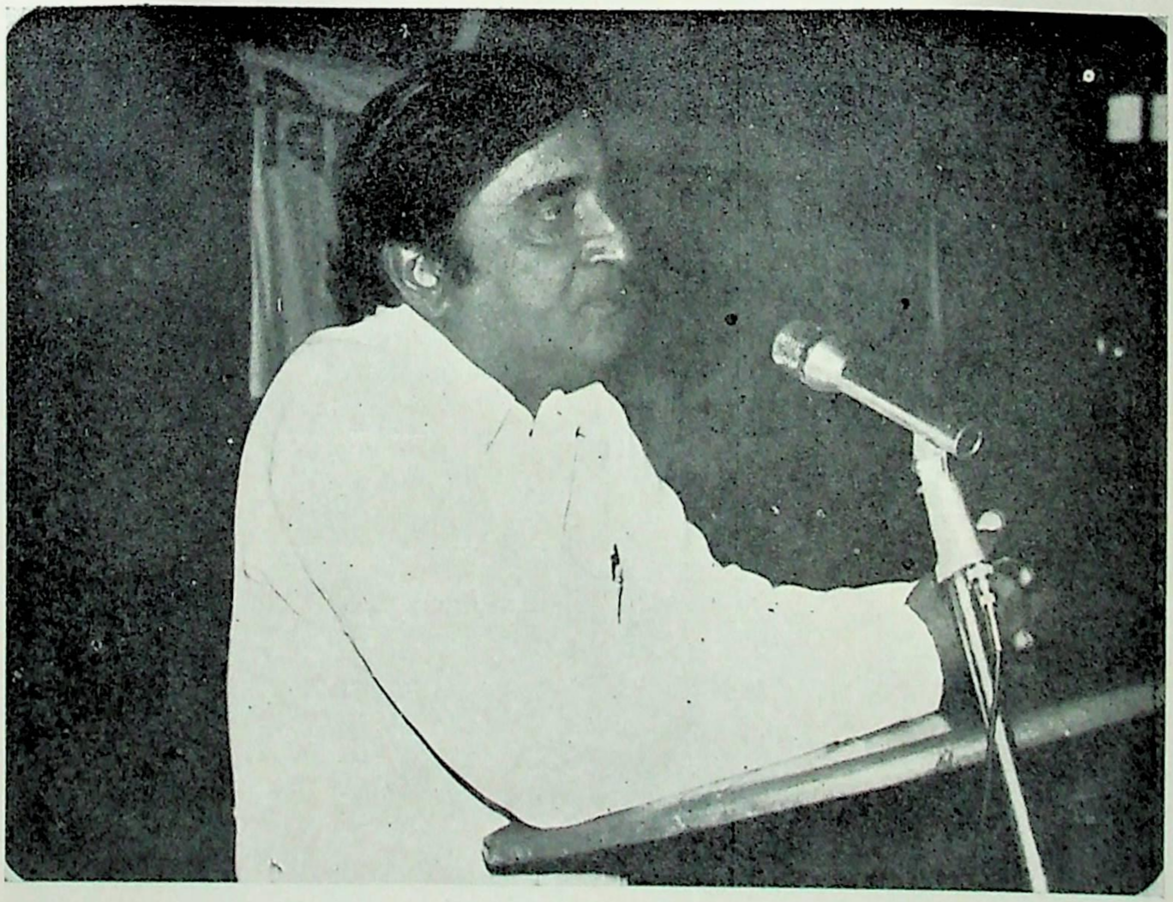
WORLD ENVIRONMENT DAY CELEBRATIONS
1983
Gurukula Kangri Vishwavidyalaya

I Conference on Environmental Conservation and enrichment.

II Exhibition on Environment



Dr. V. Shanker Head Botany Deptt. and Organising Secretary 'World Environment Day' 1983 garlanding Mr. Digvijai Singh Dy. Minister Environment, Govt. of India.



Hon'ble Dy. Minister of Environment Mr. Y. Digvijai Singh addressing the Conference on June 6, 1983.



World Environment Day 1983

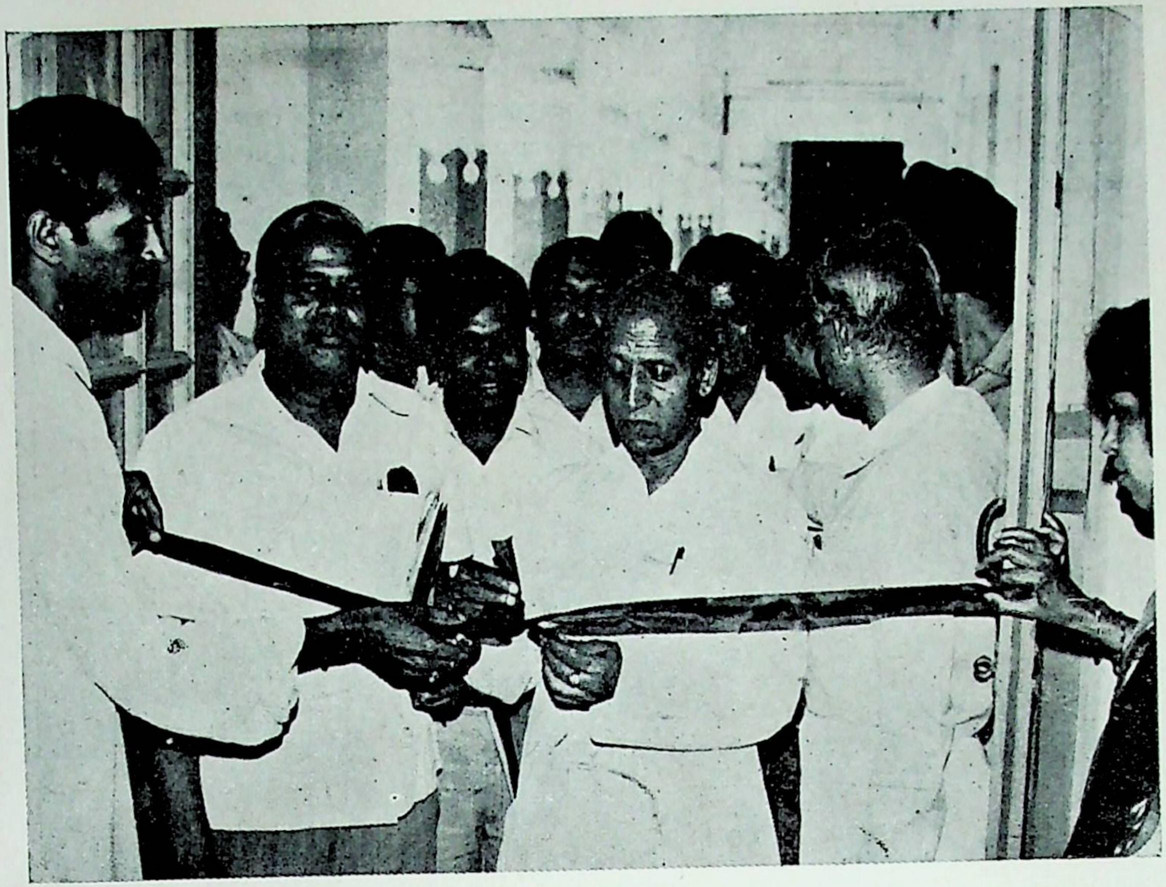
L to R : Dr. B. D. Joshi, Principal Shri. S. C. Tyagi, Mr. Y. Digvijai Singh Dy. Minister Govt. of India, Dr. V. Shanker.



CONFERENCE ON ENVIRONMENTAL CONSERVATION AND ENRICHMENT.

Sitting on the chairs from left to right are :

Dr. B. D. Joshi Head Zoology Deptt., Dr. V. Shanker Head Botany Deptt. (Organising Secretary), Mr. V. N. Shrivastava Principal Training Extension Centre, Dr. Tawade, Dean Students welfare Marathwada University, Maharashtra.

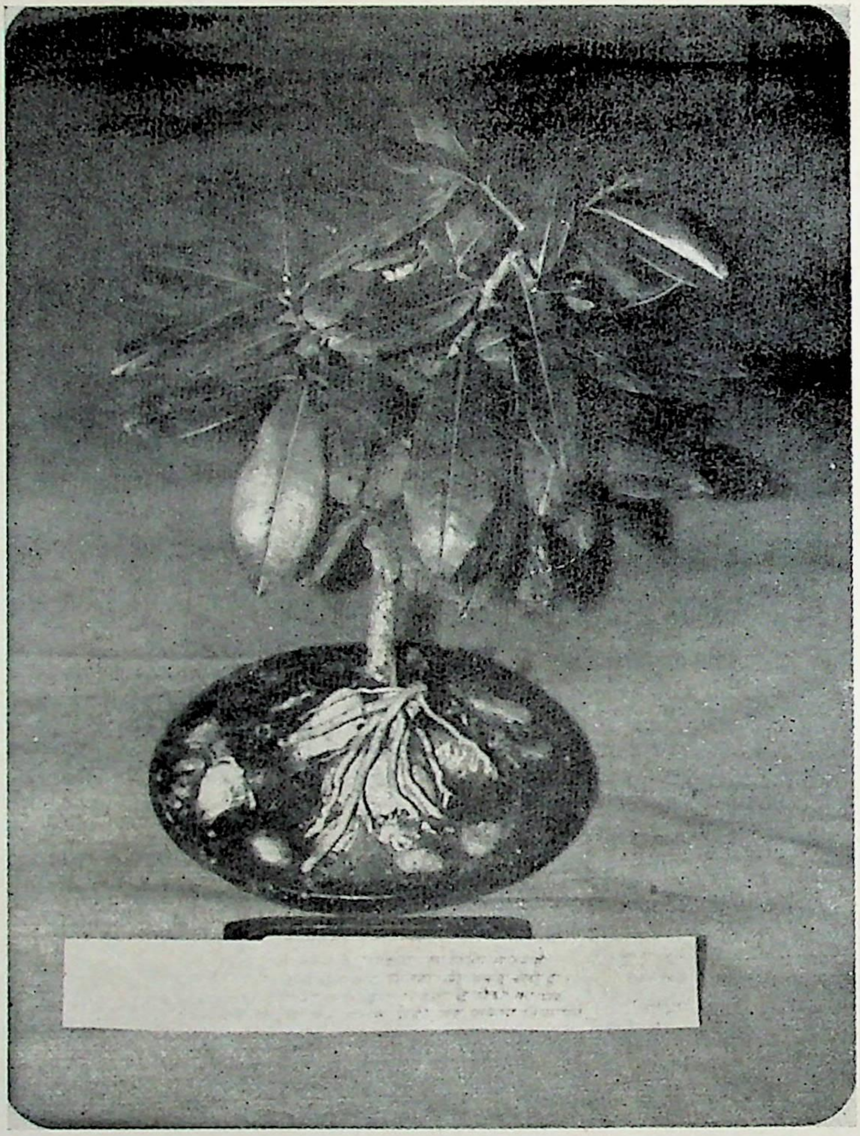


Pro-Vice-Chanceller Prof. Ram Prasad Vedalankar opening the 'Exhibition on Environment' on June 5, 1983. On his right are Dr. I. C. Gupta (Central Soil Solinity Instt. Karnal). Dr. G. Behra (Indian Photo-Interpretation Instt., Principal V. N. Shrivastava and Mr. R. C. Sharma. On his left are Dr. Chandok (BITS Pilani), Dr. P. Kaushik, Dr. V. Shanker, Mrs. Bansore.



EXHIBITION ON ENVIRONMENT :

A view of Bon-sai standing from left Mr. R. C. Sharma, Mr. Kartar Singh, Prof. Ram Prasad Vedalankar (Pro-Vice-Chancellor), Dr. V. Shanker, Prof. G. Behra, Mrs. Kunda Bansore, Dr. B. D. Joshi, Dr. P. Kaushik, Mrs. & Mr. Verma, Dr. R. K. Palmial, Mr. V. N. Shrivastava, Mr. V. Arora.



A-bonsai displayed in the exhibition on Environment' organised on World Environment Day 1983, to show the role of roots in checking soil erosion,



Shri Goswami I.A.S. Commissioner Meerut Division watering the Ashok rapling planted by him. Standing from right are : Shri G. B. K. Hooja I. A. S. (Retd.) Vice-Chancellor, Shri Sunder Lal Bahuguna (Chipko Andolan), Shri Shivnath Singh Kushwaha Minister Uttar Pradesh,, Dr. V. Shanker Head Botany Deptt.



Shri Sunder Lal Bahuguna leader of Chipko Andolan is planting a Ashok rapling in Vishwavidyalaya. He is being assisted by Dr. V. Shankar Head Botany Deptt. who is seen sitting opposite to him.

L to R : Shri Ghanshyam Pant R. M. Hardwar, Shri G.B.K. Hooja Vice-Chancellor, Shri Goswami Commissioner Meerut Division, Shri Suraj Din, Dr. R. K. Paliwal, Dr. H. G. Singh, Shri Shivnath Singh Kushwaha Minister Uttar Pradesh, Capt. Deshraj.

Life-style and Environment

At present there is a compelling reason for adopting 'vegetarian life-style' as it has great environmental benefits. In affluent nations most animals raised for meat are fed on cultivated crops. In united states 90 percent of all the grain consumed goes to feed hogs, cattle and ckickens. In this conversion of grain into meat 90 percent of food value is lost in animal respiration and undigested material and through conversion to inedible tissues such as bone, blood and tendon. This 90 percent loss of food value is avoidable if humans could take to vegetarian mode of life and feed on cultivated crops directly. We know that agriculture, as it is presently practised, is highly dependent upon limited resources of nutrients, energy and water. Besided much of the extra land pushed into crop production to feed animals is subject to erosion, which shall undercut future productivity and can create tremendous pollution problems as the soil washes into rivers, streams and lakes.

— V. SHANKER

If the laws of nature are thwarted, renewal sources will also be exhausted. The indiscriminate felliing of trees has denuded our forests with disastrous ecological imbalances affecting the very quality of life. In its sternest form nature retaliates against the scars of treeless mountain-sides, causing landslides and devastating floods and silting dams and rivers. Rain fall begins to dwindle and the desert resumes its deathly march.

We are trying to harness the vast potential of sun, wind and water. Solar energy is already being used for cooking, for heating water and pumping it for irrigations, for crop drying etc. Another promising item in the new energy programme is biogas which is produced mainly from agricultural waste not to mention the ubiquitous water hyacinth that has for years been blocking waterways and clogging fields.

Indira Gandhi
Prime Minister of India